An Assessment of Strategic Maintenance Management within a selected Steel Manufacturing Company

By

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Declaration

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Abstract

Since the beginning of the knowledge era, individuals powered their ideals on the 20th century's industrial knowledge age, also defined as "the power of knowledge". The modern day knowledge era will use the collective intelligence of diverse groups to collaborate for specific purposes and objectives. Society and education developed from the "know what" and "know how" age to "what is the best way". (NZCER, 2010)

Leading into the 21st century, organisations are forced to adapt to a new state of mind and use a diverse knowledge spectrum to solve the problems of the future. This mind-set is being challenged by a recent recession and cautious investment future. The recession initiated a negative impact on the global markets and forced most organisations to become innovative and use their collective knowledge. (NZCER, 2010)

This investigation is based on an increment of the global corporate environment. The collective thinking principle can be used to achieve success in an organisation based on a first and third world country, i.e. South Africa. The concern, Hall Longmore (Pty) Ltd. opened its doors to a 21st century strategic solution in respect of its maintenance department. Maintenance at the concern is currently a decentralised employee structure, where the current culture of the group impacts negatively on the performance of the department.

During the industrial age this would have been solved by implementing autocratic structures and strict discipline on employees. This management style is feasible in the short term, but how do employees stay motivated, creative and innovative over time? World class maintenance programs need a clear vision to become a unified labour force functioning with an innovative and creative approach. The key aspects of the initial state need to be investigated and understood before decisions can begin towards reinstating the desired culture and behaviour.

The aim of this dissertation is to change the paradigm of the autocratic 20th century management style relating to the maintenance function, which aims to decrease cost and increase reliability and availability to a more performance driven culture and integrated workforce, which will create a high performance concern through its actions.

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List of Acronyms

RCM	Reliability Centred Maintenance
CMMS	Computer Maintenance Management System
LTFR	Lost Time Frequency Rate
LTIF	Lost Time Injury Free
AMIP	Asset Management Improvement Process
SWOT	Strengths, Weaknesses, Opportunities and Threats
PEST	Political, Economic, Social and Technological
PESTEL	Political, Economic, Social, Technological, Environmental and Legal
RCA	Root Cause Analysis
OSP	Organizational Strategic Plan
AMS	Asset Management Strategy
AMO	Asset Management Objective
AMPl	Asset Management Plans
AMPo	Asset Management Policy
BSI	British Standards Institution
API	American Petroleum Institute
SLA	Service Level Agreement
ERG	Existence, Relatedness, Growth
CLC	Corporate Leadership Council
ROI	Return on Investment
KPI	Key Performance Indicators
KPA	Key Performance Areas

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Chapter 1: Introduction

The maintenance department of Hall Longmore Pty (Ltd) was identified as a critical growth area of the company which, with the objective to become a world class manufacturing concern. The purpose of this dissertation strives to identify the needs within this department with the intention of becoming a leading department within the company. Maintenance can be illustrated through the unique integration of employees, skills, knowledge, processes and work methodologies. The critical success factors to a good recipe are not only the ingredients, but the way it's prepared and served.

History of Hall Longmore Pty (Ltd)

Charles Victor Longmore was tasked by the English Company (John Russell & Co) to start up a workshop in Jeppe St., Johannesburg. Mr Longmore started a Company in Fordsburg (1920) called Tube Products which later changed its name to CV Longmore & Co in 1924. In 1935 Hall Longmore was established when Leonard Hall joined the company and in 1972 the Wadeville Pipe Factory was created. In 1988 Hall Longmore, became a subsidiary company of the construction giant Murray & Roberts. (Hall Longmore, 2011)

Maintenance Hypothesis and History

The company became susceptible to mechanical failures and the following was common phrases in the passages, "it's because of the lack maintenance, operator abuse, lack of reporting and over use of equipment". The maintenance team disagreed with these perceptions. In contrast, maintenance members cannot call this a theory if they can't prove this statement to be incorrect. This investigation will indicate the methods used to determine this perception and what needs to be changed to transform this perception. The Maintenance function at Hall Longmore was initially established as a centralised unit and was subsequently, due to management changes, group decentralised. The driver behind the centralisation process was to refocus the unit on specific machinery and simultaneously increase the staff complement to cater for the new focus.

An AMIP assessment was completed in 2009 on the maintenance department. This assessment identified certain problems and critical potential areas of concern. Chapter 3 will ventilate some findings. The outcome of a study conducted amongst the employees will provide clarity and correctness of the various perceptions.

The maintenance management team was restructured during September 2010 to change the reporting line, with the maintenance function to be moved to become a subsidiary of the engineering division and as a quid pro quo engineering appointed a maintenance member into the management team. The key focus of this member was to improve the current perception of the maintenance function within Hall Longmore.

Objective

It is evident that identified problems can be resolved with sufficient resources, including accurate knowledge and systems which will be emphasis in this dissertation - to identify the primary underlying challenges and to provide a holistic solution, based on knowledge and systems. The primary company objective is to become a world class maintenance unit.

The main objective is to identify the challenges within the current structure, i.e. team, system, procedures, knowledge, training, education and/or moral culture - the outcome is to

analyse the dynamics of the maintenance function and team. An analysis will follow to gain a deeper understanding of the dynamics in the function and the influence on the future strategic plan to improve the function and to reduce one of the biggest cost drivers, overtime.

The improvements will aim to enhance the performance of the maintenance team which as a result of the changes, will improve the availability of the manufacturing plant and reduce operational costs. It is predicted that productivity and efficiency will increase; production costs will reduce and it will have a positive impact on the costs of the final product. Critical success factors include reduced manufacturing plant down time, higher plant efficiency, limiting over use and ensuring shutdowns according to regulations.

The cost of maintenance is high and reducing the maintenance cost will be the second driver by introducing methodologies to ensure on time maintenance, scheduled services inspections and preventative maintenance. The above will have a positive impact on the total maintenance cost factors and the overall benefit will filter through to the bottom line of the company.

The rationale for selecting the maintenance function for this project is to capitalise on the current negative perception regarding the team and the cost benefits which can be achieved if implemented successfully. The manufacturing machines operating at times as low as 40% OEE and this restructuring, with a larger maintenance footprint, will have a positive impact.

It is important to understand the intrinsic value of knowledge experienced workers in a manufacturing environment has as production losses impact severely on the overall efficacy of the production output and ultimately the profit of the company. It is therefore important to ensure optimal utilisation of all the components in the production chain - systems and procedure to guide and assist employees. The systems and guidelines derive from industry knowledge gained over years of experience and exposure and will assist the employees to improve the maintenance function to a world class standard. The critical glue in the process of improving the maintenance cost and production efficacy requires a cohesive team of experienced and skilled workers within a dynamic structure, within a well-developed implementation plan.

The Research Challenge

A unit culture has developed overtime in maintenance function and it will be a challenge to inculcate a new or revised methodology. Change management needs to assist in evaluating the existing culture and managing the process of reformation to facilitate a change in the culture to what is currently being envisaged. The process will begin with focusing on what we want to achieve and the benefits it will produce (planting the seed).

Then the focus will shift to assist employees in adapting to the changes and to refocus on the goals of the revised word methodology. The difficulty in changing human behaviour will not be underestimated and Human Resources will play an important role in this respect by providing assistance and guidance to all the effected employees. It is well known that employees are normally reluctant to change and one of the reasons is the fear of the unknown and their stability in the interim process. Strategic and Change management will provide comfort and be the pillars of support during the process ensuring that all the effected employees are coached and guided through the entire change process.

Sustainability is not the initial driver of the process but this will become more prominent towards the end of the process. Amendments will be considered during the implementation phase, which will ultimately be embodied in the overall strategic plan of the project.

The dissertation will provide a clear strategy which will be implemented once all the approvals are received and the funding approved. The objective should be to improve the current methodology and to capitalise on the available synergies in the maintenance function and the overall company.

Methodology

The research methodology is subject to certain levels of "subjective interpretation" and care was taken not to influence the outcome by one's personal perceptions. The questionnaires and interviews were styled to facilitate a simple process to obtain clear indications to each question. The outcome of the interview process will be influenced by the individual's perceptions of the company, the process, the outcome and other similar factors. It is therefore important to apply control mechanisms to minimise the effect thereof. Ambiguity will be limited by an approximation to the truth- statistics, which will always integrate to the norm (as the answers will always have extremes).

Extremes responses will be considered, taking into account the individuals personal circumstances and perceptions towards the specific question (Over Emotional Response), but also as an error due to sin tax, vocabulary or spelling. Care was taken to minimise the effect and this will be dealt with in Chapter 3, explaining all the extremes and rationale for considerations / eliminations, taking note that extreme responses can also not be excluded without being considered or reviewed.

A system was developed to review the sample group responses during the interview and to the questionnaire, focusing on responses and taking cognisance of the subjective behaviour. This is, once again, only a consideration and all values will be considered and extremes will be reviewed. The possibility of manuscript errors and format errors cannot be ignored and this was dealt with in chapter 3. (the detailed systems in place to ensure that the error possibility strives to zero.)

To summarise – Management has identified certain challenges in the maintenance function domain and expressed a desire to implement a new strategy to revolutionise the function. The researcher was given access to a reduced group of people to minimise the impact of the research. The sample was sufficient to eliminate the risk of a smaller group's perceptions influencing on the larger group. A selected group of people were used for this analysis which group consisted of employees from the maintenance function, maintenance management team and a small group from the production management. The inclusion of the production team was to provide an independent view (internal client). The participants were restricted to the maintenance function at the Wadeville site.

Overview by Chapter

Chapter 2[1]

The literature study shows an integration of strategic and change management to the drivers for any paradigm shift. It's obvious that change will be required, which might lead to an

[1] Extract from Chapter 2, Introduction

increase in cost despite the company's endeavours to remain cost effective. Objectives will be amended over the lifetime of the plant and the strategy will be aligned accordingly.

Chapter 3[2]

An appropriate analysis will be required once we have identified all problem areas with the intention to gather all the relevant and related information. Objective information gathering and analysis remain imperative to ensure the analysis will reflect the core of the problem. This analysis phase will be the basis of chapter 3.

Chapter 4[3]

Changes in the maintenance unit and methodologies must not only emanate from changes in discipline, processes, procedures, structures and new implementations, but from the revised culture as envisaged in the previous Chapter 3. Planning to inculcate revised culture approach of the company will necessitate careful planning and a deep understanding of the current positions and the outcome we want to achieve.

Chapter 5[4]

Implementing or execute the strategy. This is similar to the "action stage" used in the implementation of strategy. The executing stage is detailing the implementation plans to achieve the missions and visions decided upon. This is an important stage in the process and requires dedication, tenacity and sustainability as this is normally where the process gets derailed.

Chapter 6[5]

Sustaining the strategy and change. This chapter will cover sustainability of what were implemented derived through the changes in processes, procedures, people and assets with the assistance of a CMMS which will be the system administering the maintenance team and processes.

Chapter 7[6]

The chapter will cover the conclusion of the project and the outcomes. This will also be a brief summary of the dissertation.

Conclusion

Hall Longmore can be seen to experience maintenance challenge as per initial assessment and history of the unit. The company have made changes through the years at Wadeville to alleviate maintenance problems and human resource challenges. The following chapters will assist in identification of a possible holistic solution. This solution can be implemented and the Human Resource function will provide the required support not to lose any human capital.

[2] Extract from Chapter 2, Stages of Strategic Management
[3] Extract from Chapter 4, Strategic Plan
[4] Extract from Chapter 2, Strategic Management Process
[5] Extract from Chapter 6, Sustainability
[6] Extract from Chapter 7, Conclusion

Chapter 2: Literature Study

This subsection will cover all the theories and research completed in formulating an informed and structured opinion regarding the future of this study field. This will support my personal view and understanding of exciting methods, theorems and ideals backed by sufficient research on proven and practiced methods. All research theories displayed in this section will be backed by reliable sources which will be annotated in bibliography.

Introduction

The literature study shows an integration of strategic and change management as the drivers for a paradigm shift. Athletes practice daily and use supplements to ensure and assist with the daily demands on their physical strength. In today's competitive environment athletes will have to become experts in their field with specific knowledge of the industry in which they operate, failure to achieve this industry knowledge will leave them vulnerable and susceptible to the quick fixes. It is important to remain abreast of changes in technologies and the bio-kinetics fields to prevent losing their edge or any competitive advantage which they may have developed over a period of time. It's obvious that continuous changes will be required for any athlete to remain competitive - objectives will always changes over time and strategies remain aligned accordingly. This is one of the reasons why change management needs to support new objectives which might result in changes to a new strategy. This might not be as simple as it seems, but these management tools will support the new strong maintenance paradigm shift.

Strategic Management

The strategy of an organisation is a holistic approach of a larger group in an entire company. This dissertation will focus on maintenance management as one of the key components in the management function. The company's maintenance strategy can therefore be adapted and modified to address all the maintenance management gaps. Michael Porter, a strong supporter of strategic management, believes that operational efficiency is not adequate to ensure a sustainable lifespan of a company, strategy is needed (Dess, 2005). The book strategic Management: Issues and Cases also use Michael Porters' statements of unique value additions which will be the key to the customer. (Dobson, 2004). Strategy is the drivers to sustainable success by not only performing at the highest level but remain vigilant for any changes in the market.

Definitions of strategy and strategic management

Random House Dictionary describes strategy as a science or an art of utilizing, planning and directing of movements and operation. This was one of the initiatives used by the U.S Army to overpower their enemies. The word strategy originated from the Greek language and was used by their military commander. (Random House, 2011). There are models and analysis to explain strategy in business term in detailed and theoretically, but it comes down to clearly understanding the organisations objectives[7], believes and values[8] and how they will be achieved. (Dobson, 2004).

Columbus sailed the seas and discovered America by accident - upon returning to Europe he couldn't claim his accomplishment as he could not plot this on a map. Dr. Ian Mackechnie

[7] Reference to Chapter 4, Objectives
[8] Reference to Chapter 4, Vision and Mission

used this example to create a picture of a company without a strategy. A company and its employees must be fully aware of what needs to be achieved within the parameters of the agreed and approved strategy, i.e. “where it’s going and why it’s going there”. Strategic management it where a manager can visualise the future company, but more importantly what a company can achieve with the revised strategy. (Mackechnie, 2007). Strategic management by Gregory Dress and companion defines it as a combination of analysis, decision making and actions a company takes to sustain a competitive advantage. (Dess, 2005). Dress defines the stages of strategic management unlike Mackenzie’s views. Their views align more when they both discuss the future advantages. Strategic management of a company could also be defined as the tools used to ensure a sustainable future.

Stages of strategic management

The foundation of strategic management will revolve around the following under mentioned 3 steps. It might differ from industry to industry and its interpretation and implementation might differ, but the stratum remains the same.

Analysis: What is the current state of the business or the area of concern? (Dess, 2005). Where are we now? (Mackechnie, 2007). An appropriate analysis should be done by gathering relevant and related information once the cause of the possible problem has been identified. Objective information gathering and analysis are critical to ensure the appropriate analysis reflects the true core problem. The analysis phase will be discussed in detail in chapter 3.

Decision Making: Which changes are required to improve the current status of the organisation and how do we want the future company to operate? (Dess, 2005). What is the ultimate goal of the company and what is required from the company to achieve same? (Mackechnie, 2007). Chapter 4 will define the decisions required and the strategic processes to be followed.

Action: This is the mobilising stage – What are the requirements to implementing the decisions taken. (Dess, 2005). Will the organisation achieve its objectives after implementation and re-evaluation action taken to ensure the sustainability of the change for the future or until a new strategy is decided upon? (Mackechnie, 2007). The implementation stage will be discussed in chapter 5 and sustainability in chapter 6.

It is important for an organisation to continuously re-evaluate its strategy or specific areas of importance to ensure that the company remains viable and operate optimally. It is important to keep sight of the core role and function to insure that the organization remains successful. (Abdullab, 2009). Continuous improvement is a Japanese principle called Kiazen which is used at all levels of the hierarchy to illustrate that all small continuous improvement leads to a greater and more effective organisation over time.

The stages or elements of strategic management: although it is ranked with different titles the intention remains the same:(Internet Center for Management and Business Adninistration, 2010)(Dobson, 2004)

- *Research* the market;
- *Planning* strategies and goals;
- *Implementation* of the strategy to achieve goals

Approaches to strategy

Strategic approaches are the formulation of the definitions as already explained. There are different methodologies in implementing these definitions and approaches, but the most common approach is the "*top-down approach"* to strategy – this top or executive management's perception of what the company wants to achieve and the approach taken to achieve same. Management reflects on the historical information which will be used as one of the tools to determine the way forward and act as and when needed, where the other approaches are to implement a *system of management principles* which could control the actions or issue at hand. (Dobson, 2004)

A combination of both strategies could be implemented when it comes to departmental management and improving sections within the business unit. The most desired strategy will be explained in chapter 4 where the combination of the employee's views and a system for maintenance are formulated to focus on the sustainability of the maintenance unit and its skills and experience levels.

Strategic management process

The origin of conflict or war is relevant to corporate industries when companies are considered as armies for their respective products or services. If the armies are equipped with the same gear and the same strategies for defence and offence, then the teams are lining up for suicide and both will fail. Similar strategies can also be an opponents' weakness, indicating that they follow the trend but are not in creative mode. The strategy hierarchy of goals, policies and programs also originated from the military which is a *systems approach* as explained previously[9]. The strategic management process can only be followed after the various stages of the historical strategic management plan has been reviewed and reconsidered, and failed towards alignment with the organisation's prospect. The failure will call for change and therefore the process will commence: (Dobson, 2004)

1. **Creating a vision:** A new vision needs to create a panoramic view of the future company. The vision is the core to the paradigm shift, a single statement of excellence that contains goals of transformation from the current state to an unknown but strategic improved future that will become a sustainable company culture.

2. **Create a mission:** this mission should complement the vision and understand the change that leads to this improved mission. Once again, this is a single statement which creates a cumulative image of all the participants to achieve the vision.

3. **Set the objectives:** This process focuses on the changes required to achieve the revised vision and mission statements. This is multiple tasks which will make changes to the existing structure to enhance and embrace the current strengths of the organisation, but simultaneously address the possible weaknesses or area of concern. Also known as Environmental Scan (Internet Center for Management and Business Adninistration, 2010): scanning the environment needs some specialised techniques which have been developed for external macro environment like the PEST, PESTEL and SWOT Analysis[10].

[9] Reference to Chapter 2, Approaches to Strategy
[10] Reference to Chapter 2, Strategic Model

4. **Create the strategy:** The strategy will be the roadmap to achieve the set objectives[11]. This will not necessarily cover all the objectives but subject to the proviso that it will improve the current state of the organisation to a more acceptable standard. Chapter 4 will also show the effect of focusing on one set of objective that will improve others by a flow over effect.

5. **Implementing or execute the strategy:** This is the same as the action stage in the strategy roadmap. The executing stage is implementing all the plans, missions and visions into action. This stage requires meticulous planning and requires dedication, tenacity and sustainability.

6. **Evaluation:** After a period of time the strategy needs to be evaluated and performance decisions needs to be made. (Mackechnie, 2007). This is normally a short period and get exponentially more involved as time progresses. Evaluation of the overall project should focus on the impact on the larger group and should not be contained to the focus area. This wider impact assessment provides a holistic view which will deal with negative perceptions created. This will allow the project leader to deal with these perceptions and to facilitate improvements in the strategy. Strategy implementation does not need to be a paradigm shift every time, but could be small incremental improvements.

Companies will evolve over time and go through strategic changes; constantly reviewing and re-evaluating itself. Steps 1 to 4 will form the basis of chapter 4, which will concentrate on how to create a strategy where step 5 will be the basis of chapter 5 and 6 respectively - How to ensure a sustainable strategy which is flexible to performance changes and decisions made and implemented.

Strategic Model

A strategic model is developed to influence competitive behaviour, implement initiatives and generate changes in the business approach. Re-active companies, from a strategic perspective are normally challenged when the markets force them to reconsider their strategy; pro-active companies are visionary and are vigilant towards the changes in the market, which could impact on their value proposition. (Mackechnie, 2007) . A thorough knowledge of the company and its organisational ability in their field of expertise will assists in analysing previous achievements and the successes of what has been attempted before. (Dobson, 2004).

One of the common risks is the authenticity of the historical record keeping and its current relevance (secondary data sources), recording detail and events of the past must provide sufficient information and data for comparison and a strong foundation for existing operations. There is a chance of failure as a result of poor sustentative support from internal or external data which will be discussed in the next sub section of Lussier[12].

[11] Reference to Chapter 1, Objective
[12] Reference to Chapter 2, Failure Characteristics of Strategic Management

The model in **Figure 1: The strategic management model** divides the Strategic History into two common analyses. The first being the environmental analysis which uses the PEST analysis and the second being the organisation evaluation regarding structure, values, culture, resources. The subsequent phase will involve the use of the SWOT analysis to analyse the opportunities and threats of the stakeholders that emanates from the environmental analysis (PEST). The strength and weaknesses will emanate from the current state of the internal organisational analysis to improve for a better vision. By combining the outcome of the two analyses, the strategy of choice must be decided upon and implemented. (Dobson, 2004, p. 4)

PEST analyse the organisations industry regarding political, economic, social and its technological state. This can also be expanded to the PESTEL analysis to include the natural environment and legal implications if needed. The internal technique known is the evaluation of the strengths, weaknesses, opportunities and threats (SWOT Analysis). Michael Porter's five forces can also be used, but this will be discussed at a later stage[13].

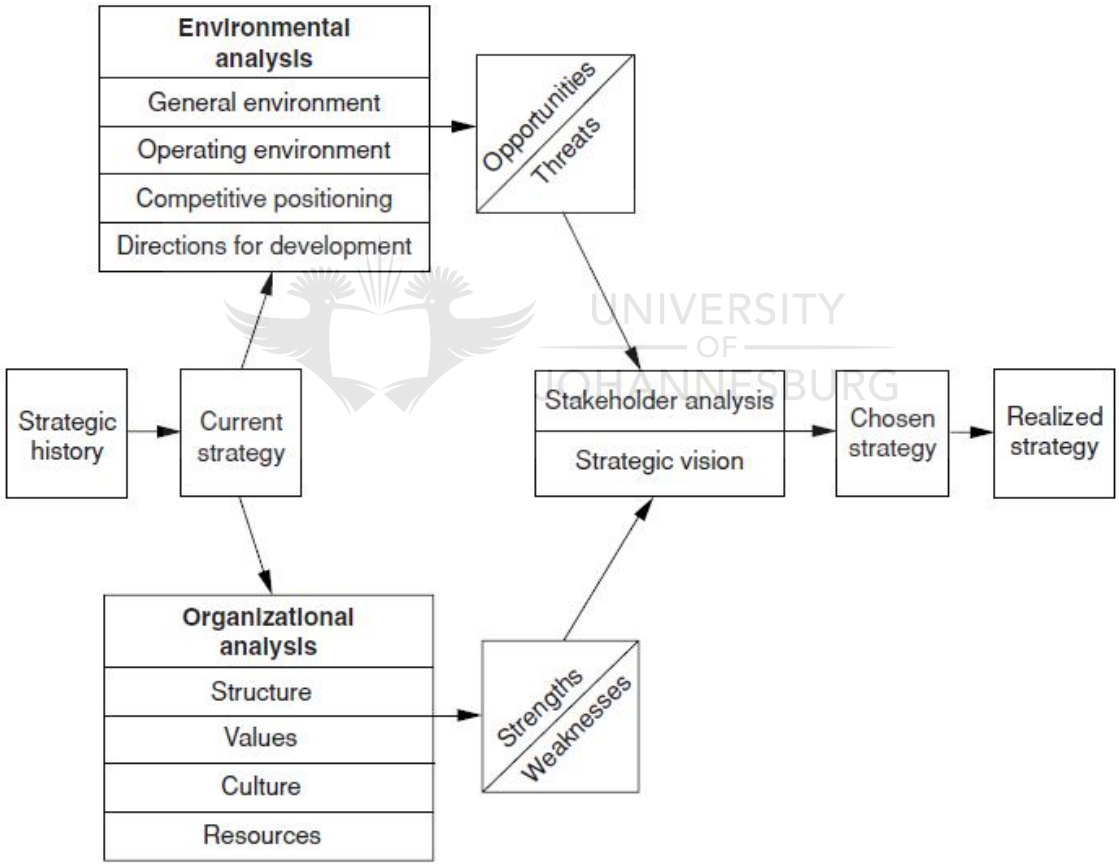


Figure 1: The strategic management model (Dobson, 2004, p. 4)

The environmental analysis used in this project will not cover the entire organisational influences, but will consider the internal influencing factors and direct stakeholder's involvement. The important influence will be included in the internal strategy where the structure and performance of the maintenance function will be evaluated together with the importance and relevance of each role within the structure.

[13] Reference to Chapter 2, Porter's Five Forces

The Maintenance Department requires a paradigm shift which will be dependent on a positive approach and using predefined goals to achieve the desired outcome. This will further be subject to quality relationships between individuals and other departments / business and utilising all the available resources optimally. The Employees are the most important asset of the organisation and requires constant interaction to stay focused as a unified team with the company's requirements as the main object. This will facilitate a healthy working culture and environment which could impact on each individual at work, or at home.

Failure Characteristics of Strategic Management

Lussier explains the characteristics of the failure of strategic management principles by using four elements. *Understanding the customer – this* is the horizontal approach which must ensure that the strategy is applicable to the environment and that employees will accept the initiative. *Commitment of employees and management* is the next step, subsequent to having a strategy, which is applicable to all employees and management and subject to all sharing the same vision and strategy and have the same commitment to embrace the vision.

The third step is *Change of management and plan* and this covers the restructuring and the physical and physiological effect it has on employees. Does the organisation loose high value workers or placed individuals not according to their skills, abilities and experience in the structure? *Communication* is the key to success and the lack of proper communication will severely impede the successful transition to change brought from the strategic plan. (Lussier, 2006)

The success of strategic management

The four pillars to success starts with building a vision which is inspirational, but also take note of realistic boundaries. This is also where Steven Covey refers to the matter of "starting with the end in mind" (Covey). The next step is to achieve an overall buy-in from the team, followed by physical implementation of the agreed strategy and constant reviews to ensure adherence to agreed principles. During the implementation phase it is also important to ensure that the constant reviews involves all levels of the organisation and that people are empowered to succeed within this framework as John Maxwell said.

The final pillar requires leadership and to lead by example. (Connemara, Murray & Roberts, 2011, pp. 6, day 9) Strategic management brings changes into an ideal world and these change needs to be managed successfully to ensure that the strategy and vision is achieved. Beer and Nohria – BHR stated that normally 73% of all changes initiated fails due to the change not being managed, even with strategic plans being closely monitored, it is still possible to fail, but careful planning can reduce the risk of failure. (Connemara, Murray & Roberts, 2011, pp. 23, day 9)

Change Management

Maintenance management is planning on a strategic chance and the management role is the collection of information to ensure that the change will be done strategically with the end in mind. The strategic management process[14] explains how the change process will be achieved. Change management needs to be integrated into a strategic management plan or process to change behaviour of the individuals involved as this will not influence their respective skills or experience per say, but can implement other measures to address this.

Management understands the need for change and implement the change but could become subjective implementation that also needs to be controlled. The strategy will improve the maintenance department's outputs and objectives, but it's critical to create a vision and mission where you obtain overall employee acceptance. Full acceptance of the project and process is never a given and Management needs to ensure optimum participation and acceptance of the entire project and its objectives and ultimate goals to ensure optimal performance. This might lead to slower progress and smaller incremental steps to ensure full participation.

Definitions of change and change management

A further possible definition of change and change management can be found in the Random House Dictionary where change is described as a transaction (as its Middle English origin) which will be a different form, nature and content, but most importantly the future course is different than inception (Random House, 2011). Change in the corporate sense is also described as a continuous adoption of new or revised corporate strategies and structures. Change will be influenced by the individuals' personal circumstances and behavioural framework and ability to react to the environmental changes. The personal change can be easier facilitated if assisted by a leader / mentor who provide guidance during the transformation process. (Dr.Malan, 2010)

Change management now transforms the word change from the future paradigm to the techniques used to create this evolution, composition or policy that will design the management transformation, but only by action. This means that change management is the implementation of change and has techniques or ground rules to guide the success of the transformation. (Howe, 2010)

Principles of change management

Professor Rosabeth Moss Kanter said that change management is: "a culture that keeps moving all the time." This statement emphasises the principle that change should be a continuous process. A company or its employees who do not embrace this constant change philosophy will live in a culture of fear for change, and the company and employees will stagnate or move into the "comfort zone" – in the longer run this could result in them not even reaching the status quo, let alone being competitive in the industry.

The principle of change is one of the key pillars of a survival strategy for the 21st century, the success of strategic management, implementation of revised plans and processes are subject to a deeper understanding of the human elements and behaviour during a change management process.(Jones, 2004)

[14] Reference to Chapter 2, Strategic Management Process

One of the main concerns of transformation is the possible negative reaction of the workforce to the proposed changes. The challenge will be to enhance the team cohesion and still lead the team through the entire change process; not ignoring the importance of the human resources aspect (sentiments and behaviour) and the reaction to and reluctance to change which will impede the ultimate success envisaged. The following guideline principles can be used as guidelines to address the individual's reluctance to change and strategic management. (Jones, 2004)

1. **Address the physiological aspects systematically:** Conflict is one the first reactions to change, due to individual's reluctance to change, new working methodologies and especially the new leaders. The process of change often leaves employees feeling vulnerable and insecure; this is normally the reason for their actively or passively (behaviour) and resisting the proposed changes. The physiological aspect plays an important role in changing the culture or process and can cause resistance and ultimate failure.

2. **Start at the top:** Top management is the first level, management needs to embrace the revised strategy and walk the talk to demonstrate commitment. Leaders will consistently be in the spotlight and need to reassure the team of their full commitment to the process; this must be visible to all to inculcate the new or revised culture and processes.

3. **Participation of all:** Involve all levels of the organisation, from cleaners to CEO (lower and mid-levels) and constantly reassure all of the shared vision and mission. This will create an opportunity for emerging leaders to stake a claim in the future of the organisation.

4. **Formalise the process:** Individuals reluctance to change can develop negative sentiments if the entire change process is not visible and properly explained to all. The plan must be understood by all and requires constant interaction and intervention with all to embed the process and possible outcomes, creating the shared vision. The initial step should be a formal cost benefit analysis, motivating and justifying the need for change.

5. **Create ownership:** The change process requires an active acceptance and positive involvement of all; employees need to embrace the partnership philosophy whilst "living" the new process.

6. **Constant communication:** Change managers often neglect the possibility that some individuals can lag behind or become passive participants in the process. The communication process should be interactive with all and ample time must be dedicated to ensure the involvement of all and to re-confirm the shared vision. This will reassure individuals and create a sense of confirmed participation.

7. **Inculcate the new culture:** The revised culture and behaviour required need to be reconfirmed during all communications sessions and it remains a prerequisite that the required strategy is properly understood and constantly confirmed. This will ease

the evolvement process into the revised culture and diversions need to be realigned immediately.

8. **Address cultural diversity**[15]**:** Culture diversity will play an important role on individual's reaction to and how they will deal with change. A deeper understanding is required to address each group's perceptions, habits and behaviour in order to create a cohesive team of active participants. Failure to address this important diversity issues will possibly result in individuals not performing at an optimum level. Diversity should carry the same perceived value as all the other changes factors as it plays an important role in creating commitment and sustained improvement.

9. **Contemplate changes to the approved/ agreed way forward:** The implementation plan must accommodate possible changes and amendments as all the variables might require alternatives to be implemented. The team must be susceptible to changes in the approved strategy as more information becomes available, subject to the team's acceptance thereof and the changes being properly communicated to all. The effect of these changes must again be contemplated and addressed in advance.

10. **Communication:** Constant interaction and engaging with all the employees on a directly and on a professional level must be a priority in the changed culture to assist with complete acceptance and adoption of the strategy. (Jones, 2004)

This might require special prioritisation as amendments and changes are labour intensive, which may require outside contractors. The use of third parties can cause delays, this process must be managed to ensure timely delivery – delays will hinder the transition process which could result in the loss of significant implementation time (Doherty, June 2006)

Change Management Processes

The following processes will include the various stages and possible steps of general change management models.

Kotter's Change management process:

Kotter describes the efficacy of the change management process in eights steps and in three stages. The three stages are universal in change management models:

- Reparation
- Engagement
- Implementation

The preparation covers the first three steps of stage one. The first step is to increase the urgency for change and to ensure that all the participants must embrace this urgency. Support this by instituting a team of change agents, which will provide assistance and guidance with the transformation process.

Stage 2 is the engagement process with all participants and the implementation of steps four to six. Continues communication (step 4) is required to ensure that the strategy remains

[15] Cultural Diversity is not ethnic background but personality

focused and empowering (step 5) the participants to confirm the culture “of everybody is important.” This is confirmation of short term gains and accomplishments (step six).

The third and final implementation stage consists of two steps. The first is to continue irrespective of the obstacles or difficulties encountered to ensure completion and reassure the participants of the importance of achieving the end goal. (Connemara, Murray & Roberts, 2011, pp. 48, day 9)

Prosci Change management process:
This again consists of three stages, but described differently. Phase one is the preparation phase for envisioned changes where this will be broken down into 3 steps. Step 1 is to identify and define the strategy, prepare (step 2) the team to manage and then to develop (step 3) a sponsorship model.

Stage two is managing the change by developing change plans and implementing it. Stage three is to reinforcing changes in its three steps. The first is collecting and processing the feedback of the change, then identify possible gaps and manage the challenges and areas of concern – implement corrective action to ensure a successful completion of the change project. (Connemara, Murray & Roberts, 2011, pp. 49, day 9)

Adkar Change management process:
This process consists of 5 stages where individual steps are included. This evaluates the risk of not making changes and the efficacy of the organisation (1st stage). Create the desire (2nd stage) by all participants to change and use this as a motivator to gain acceptance of the proposed changes. Knowledge (3rd stage) where the physical changes are seen to be important, but what is required (4th stage) from the team to effect the changes. The fifth and final stage (5th stage) refers to the constant reinforcement of the strategies and to ensure a continuance of the change. (Connemara, Murray & Roberts, 2011, pp. 50, day 9)

Personal change

There are six stages in the personal change process which all individuals will experience in one form or another. It’s important to take note of the different cognitive behaviour to change by individuals, mostly caused by their perceptions and internal thought processes. This is also a contributing factor for variations between the different stages which depends on the difficulty of the change factors required. It’s important to conclude every stage after the change process, failure to close stages will hamper the progression to the following stage, which will result in confusion and in turn hinder the success of change strategy.

Fluctuation is a physiological term for being stuck between two stages; going back and forth. All these stages have different time spans which are directly related to a problem and not necessarily a general set standard or rule. When psychologists use the statement: “something went wrong in your past” it describes a process or stage which was not properly closed in your past.

The terminology of old contentment is used to explain the current comfort zone people operate within. This is viewed as unconscious incompetents because its business as usual. A person will start with the stages as soon as the environment changes and denial starts. (Internet Center for Management and Business Administration, 2010) (Dr.Malan, 2010)

1ST: Denial:
This is the stage of disbelief due to the recipient's inability to contemplate or a rejection of the facts presented. In business this is generally a stage which is short and quick because the denial will be addressed via negotiations and bargaining. This can be compared with losing a loved one; accepting their passing could take a while. This causes a rationalisation of inflexibility and reinvention of the past to ensure business as usual. (Malan, 2010)

2nd: Bargaining:
The bargaining stages are where the recipient is calculating the losses and starts losing confidence. This lack of confidence opens the door for exploiting "harm" to the change strategy. Involuntary bargaining has now begun to ensure that the effects on the strategy are minimal. (Malan, 2010)

3rd: Fight – Flight – Freeze:
This stage is a period of confusion and misalignment. Misalignment can occur in the past, present and future which creates a back and forward oscillation that affects the recipient's lifetime and future. The fight-flight-freeze is the reaction as a result progress of change at this stage. Normally only one of these will be the reaction; fight is normally when anger and hard resistance sets in and flight is associated with panic and anxiety. Freeze is a lower energy response where a sense of loss or depression sets in. (Malan, 2010)

4th: Testing:
Sometimes testing can be a method of hindering the success of change strategy implementation. Over preparation or planning to perfection is a way of staying in the past. The opposing reaction here is called future focused where the recipient start exploring the changed future and starts thinking of new alternatives for an improved present. (Malan, 2010)

5th: Acceptance: Active or Supportive:
Acceptance seems like it's a quick and easy stage but there is two ways of going through this stage: the first is called active by participating in the change and living the present and be supportive which is seen as active but with support from another change agent. (Malan, 2010)

6th: Pro-Action:
A new innovative renewed feeling comes from when the recipient values the change as a positive, leaving them feeling rejuvenated and motivated. This acceptance of change could result in them seeking new possibilities and opportunities with the company both for personal and professional gain. (Malan, 2010)

The terminology of new contentment is used to explain the future of the recipient. This is viewed as unconscious future competent because it's not business as usual but rather a challenge for the future. (Internet Center for Management and Business Adninistration, 2010) (Dr.Malan, 2010)

Leading change

A change leader is needed to ensure a successful transformation will take place. The Corporate Leadership Council (CLC) explained the following behaviours of successful change leaders:

- They have a sense of direction, but also set the direction for change.
- Ensures that there is always a consensus and agreement between the leaders of the change.
- Top managers should be enthusiastic and positive drivers of change.
- Creates a team spirit where even the lowest position holders (cleaners) are considered to be a member of the team.
- Engages will all levels of management and don't delegate all the tasks but ensures some of the weight on themselves. (Malan, 2010)

Great leaders also need great communication skills and Malan uses six basic principles to explain this communication:

- Start with end in mind;
- Always participate;
- Alignment and clarity of the end;
- Relevancy is the key to the stakeholders;
- Cover positioning, purpose, present, picture, plan and plot with all the stakeholders; and
- Be committed.

Leading Management:

Effective leadership comes through communication where a group of people will follow the leader. The change methodology or processes starts with the power of one, the "Change Maverick". The initiator needs a creative minority to commence the change too. Critical Mass can be at 15% of the company's employees. The critical mass will encourage the committed majority 50%. Change will continue till competent masses are reached, the ESP Model simulates the reaction to change due to the Pressure and Space partitions (Empathy included). People resist change due to the unknown factors. (Internet Center for Management and Business Administration, 2010) (Malan, 2010)

Motivation and Goal Setting

Arnold Mol's theory of setting goals is a highly used and critical part in employee teamwork and goals to be achieved. The principle works basically like this: employees should set their own realistic goal. Then the employer will lower this goal slightly as a motivator because increasing the target creates an atmosphere of negativity reducing their motivation. This decrease should reflect an increase over the previous achievement to ensure a better result although the target is lower. This sometimes encourages employees to reach the target quicker and even increase the pace or time frame set to achieve the initial target. (Mol, Goal Setting)

Arnold continues to define motivation as the power not to make employees do tasks but rather to get an employee to do a task out of his own free will. If an employee is motivated in his/her own job he/she will go out of their way to do what is best however when an employee is told what to do before a certain date and it's done, that employee was moved not

motivated. Moved is a concept that Arnold uses to show that not all tasks done on time were because an employee was motivated, but rather because he was moved or forced to do it. Both of these principles work, but motivation takes less involvement and stress. (Mol, Motivation)

Strategies Skeletons for Specific Environments

These topics may not fully relate to the thesis, but the skeletons forms an inherent basis of the thought processes behind the development of the thesis.

Porter's Five Forces

Understanding the organisations power hierarchy is the basis of Porter's five forces. The identified strengths of the organisation will be utilised to enhance the delivery, whilst the areas of concern (weaknesses)[16] will be addressed and improved to further enhance delivery. This concept will enhance the strategic competitive edge required in terms of the revised strategy[17].

Porter is explaining five forces from a supply chain perspective but using this principal in maintenance with internal and external stakeholders or internal and contracted labour. The supplier's power is to drive the prices to higher profitability. Suppliers can analyse the need for a product and control the price to a certain extent, which will increase as the need increases. Maintenance is a company need and the suppliers of these needs are people and not goods; meaning each employee has a different Porter force towards their need.

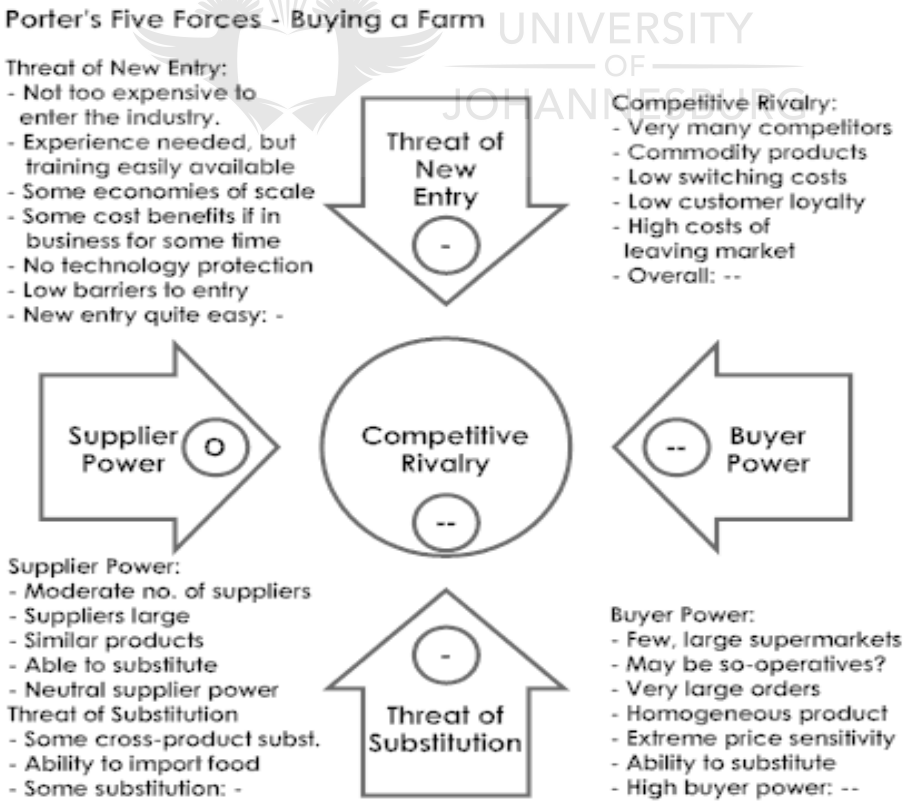


Figure 2: Porter's Five Forces (Mind Tools Ltd, 2007)

[16]Reference to Chapter 2, Figure 1: The strategic management model
[17] Reference to Chapter 2, Strategic Management Process, Step 6

This is even more applicable to specialised or unique products where the competition is less fierce, which increases the leverage of the suppliers. The buyer's leverage is to force reductions by using alternatives of multiple suppliers, which might reduce the company's underlying costs. The volumes bought and the frequency of future purchases will play an importance role for any supplier as continued trades will be more lucrative than once off transactions from any customer. The correlation between price, availability, service and comfort can be disturbed, which might force the prospective buyer to find alternative suppliers or methodologies to satisfy the company's requirements. The risk of losing skills and experience must be considered when outsourcing of some functions of the maintenance unit becomes a possible option to consider.

Influential buyers will normally exploit their position of power and attempt to dictate market prices. This behaviour is dependent on the ability to secure large orders with multiple suppliers in the market or same industry. The total cost level and services in the industry will be assessed to identify the best product at the best price at the most convenient location. The opportunity of substituting a product is a continuous process and investigation to maintain the competitive edge will be an inherent strategy.

The ability to substitute products enhances the buyer's value proposition and leverage in the market. The ability of a new supplier entering the market is dependent on overcoming the barriers to entry, i.e. capital, infrastructure existing market. Opportunities for new ventures exist where the life span of the future business is unlimited and the barriers to the new venture are low. This will influence the volume of competitors in the market. (Porter, 2010)(Mind Tools Ltd, 2007). This appears to be an aggressive strategy, but very successful in a market with multiple suppliers and products.

Porter's principal is the best explanation and comparison found because corporate giants will not readily admit to this principle. If a department becomes ineffective due to lack of expertise, the Porter principal can be implemented. Companies aspire to align their value and mission statements to their products. Companies will normally consider outsourcing their logistical function to operate more optimally as various options are available in the market. It becomes a mathematical exercise to calculate the benefits of outscoring if all the factors have been considered. This "outsourcing process" might even become outsourcing to an in house company. This same principle can also apply for other functions, i.e. Engineering, Human Resources, Industrial Relations, Maintenance, Projects, etc.

Baldridge

Paul Steel explains that everything is a process or part of a bigger process. The Baldridge excellence model is a continuous improvement process that organisations use for optimal business performance. Employees are often ignorant that other best practices and processes exist and this figure below shows how this can form a framework of current or missing core processes. If the links are properly restored or used the Baldridge model remains just a framework behind all the processes currently being utilised and this will then become the best practice and processes.

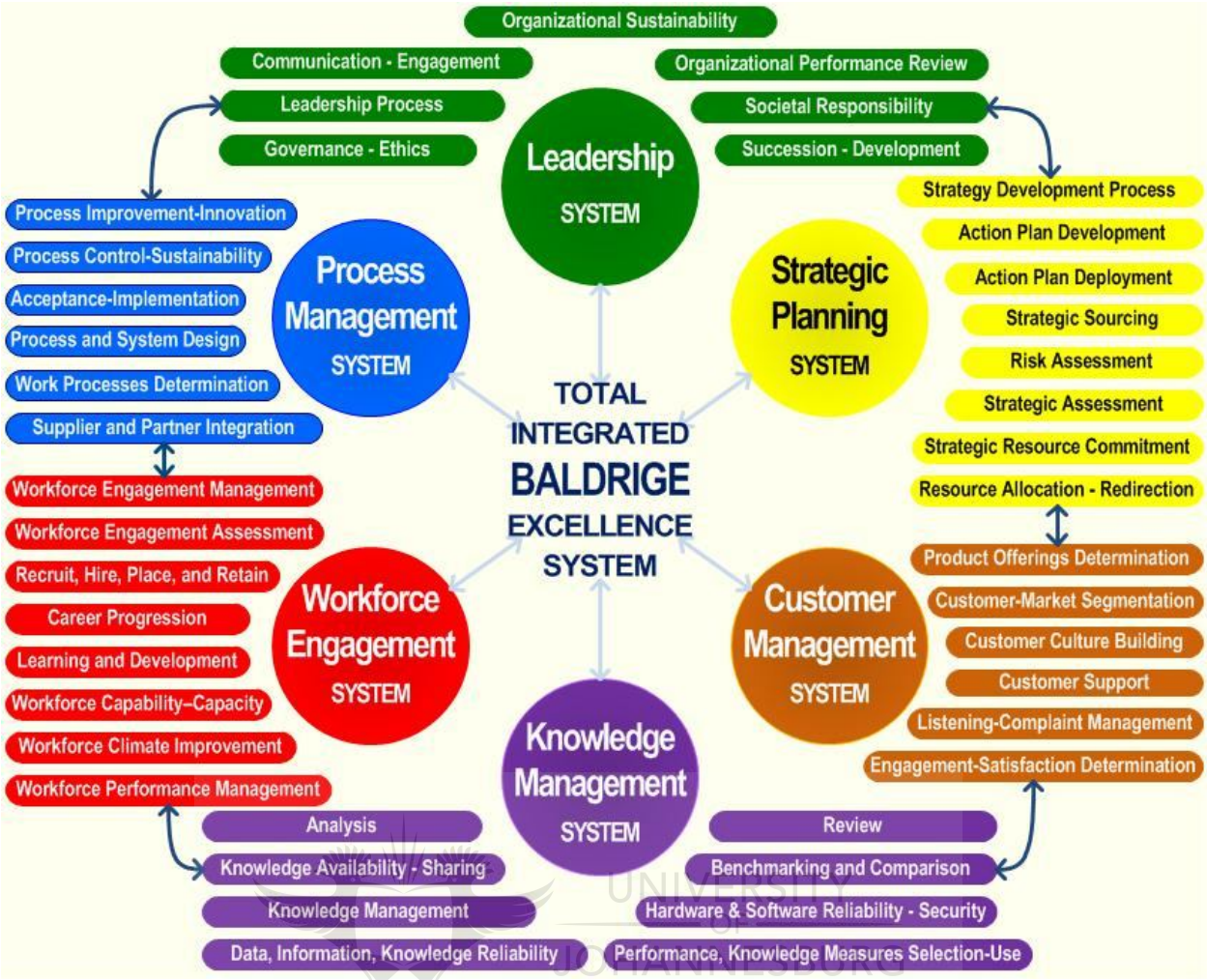


Figure 3: Total Integrated Baldridge Excellence System (Paul Steel)

The core processes of all organisations are described through the six main circles above. The core processes needs to be accepted and driven by all the involved managing employees. These core processes are individual entities but should be used with integrated knowledge, which can be linked by different approaches and the project leader should have a deeper understanding of this model to actually benefit from the rationale behind the model.

The Baldrige system has very specific core values to ensure the model functions optimally. These core values are used to ensure the application field is continuously sustainable and well developed. The principles of the model and the core values will be used for the purpose of this dissertation in an effort to create a continuous and sustainable model over a protracted period of time. These values create an understanding of the focus area and what is required to achieve the objectives within the boundaries and limits permitted. It's important to identify the customers and utilise their feedback and the driving forces behind this change. This change should be managed by strong leaders and should focus on continues improvement as knowledge and learning expands. Team involvement and shared participation will aid in developing an employee's assisted supported improvements. The success of this change should be quick and easy without drastically disrupting or interrupting the normal routine. Developing quality systems and a proactive working environment is simultaneously done to ensure that the change will result in a positive spinoff for the

company. All actions should be focused on what needs to be achieved and the long term view for the company.

Data needs to be collected and decisions need to be made on factual and uncorrupted data. A trust relationship should be developed between all internal and external customers and suppliers to ensure a partnership is developed that will cater for the wellbeing of all involved. Always ensure that all standards are met when it comes to health, safety, environment, manufacturing and business. Ultimately all companies are focused on the return on investment (ROI) and finally results should be the driving force behind all actions.

Conclusion

All problems can be solved with proper knowledge and systems as mentioned in Chapter 1. Finding the core problems or the root cause of the problem are critical to the success of the maintenance paradigm shift.[18]

The research shows the definitions, stages, approaches, processes and models of strategic management but basically this is just the framework and control boundaries for this research methodology. The stages of strategic management explain how to approach all problems in a strategic manner. First analyse the problem at hand, then making a decision and acting accordingly, there are numerous ways of approaching strategic management but the common two elements are using the management top down approach by making use of historical data and implemented accordingly. Regarding matters at hand, system of management would be the best approach and there are processes and models which are developed to assist in proper strategic management implementation. The most important is to know your customer, commit and change but do not fail to constantly communicate and the probability of a successful change will be high.

Strategic and change management will be used to analyse the current challenges and identify how to change it with managing the change as it unfolds. Porter's Five Forces and Baldrige were researched to form the skeleton that will be used as a foundation and the strategic management and change will be the building blocks of success.

Change will always be needed to ensure the product or system stages remain competitive in the market or environment. The principle of change explains exact requirements that will be needed to manage change, leadership is a key aspect which is needed to manage any uncertainty that change may bring about within the organisation. Individuals will experience many personal changes in addition to changes in their roles and emotions as a part of an entire organisation, the physiological aspects come with change and should be addressed.

This change will involve mainly people and this cannot be done with strategic management alone. The key to making change is constant concise communication with all individuals involved (this includes the entire organisation from lower lever to top management), good leadership with a strong plan of implementation, and continuous monitoring and improvement of the change strategy. It's always important to understand the business and all external input and output that could change the dynamics of any business and make alterations, by monitoring changes and adapting accordingly. The key to success in the overall strategy is that it is aligned and forms the basis of the company's objectives.

[18] Chapter 1, Objective

Chapter 3: Maintenance Assessment

Introduction

The selected group of people used in this analysis were all directly involved with and working in the maintenance unit and consisted of employees from maintenance and maintenance management. A small group of production management staff was included for an independent view. The production management group is also considered as a directly involved group because of daily meetings, schedules checks and maintenance planning. The sample size was strictly selected with people that interact daily with the maintenance unit at the Wadeville site. The aim of this assessment is to determine the strengths and weaknesses within the maintenance department and align same with the company's objectives.

The purpose of the analysis is to challenge the perceptions that the maintenance unit is in a defensive mode and concentrate on crisis management. By analysing the current situation, the environment it is operating in, the resources required, including human resources available, one could formulate a clear picture of the weaknesses and strengths of the department as this is used as a building block in an endeavour to improve the current function. The hypothesis will be that a shared vision and mission, supported by a strong implementation plan, improve the image of the maintenance function. The analysis will test and later reflect the employee's transparency and sentiments towards their own maintenance unit.

This chapter will ventilate and discuss the efficacy of the maintenance program of the company and the potential challenges / solutions / opportunities which might exist in enhancing and improving the maintenance program and its requirements. A person needs to have a deeper understands of the requirements of such a maintenance program and the costs involved in understanding the intricacies of the process and the current standing of the company.

Chapter 4 will provide more insight into the strategic planning required and simultaneously formulate a plan of potential actions to enhance and improve the maintenance program. It is perceived that the company's senior management team views maintenance as a potential cost saver and continuously strive to reduce these costs. This hypothesis integrates the relationship between production and maintenance as this will become an inclusive process whereby production will be co-responsible for the maintenance program and associated costs, including efficacy thereof. This will form an integral part of the production team's annual budgeting processes and responsibilities

This will create challenges for the production and management teams, but resulting in a better understanding of the maintenance cost requirements, including the important skills requirements and the associated costs with downtime and other similar events. The input and contributions of all the role players in the manufacturing chain, including the lower levels (operators) will now become critical in decisions relating to the reduction of the maintenance costs.

A further potential risk was identified during the interview process. Conducting the interviews created expectations among maintenance employees that changes will be effected and improved systems with increased structures will be used. Although these expectations are

good from a departure point of view and assisted in creating team cohesion, it created a liability in perceptions of what to come. Failure will increase animosity and distrust in the integrity of the management team. The monitoring of the success of the program will be determined by the ability to monitor the progress and to substantiate successes and areas of concerns. Chapter 5 will assist with an implementation plan to clearly guide the managers through this change period. It is extremely important that feedback remain factual not manipulated in any way as this will discredit the program owners and create uncertainty.

Initial Assessment (Hypothesis)

An assessment of the company's sentiment indicates that the maintenance function is an expense which must be performed within an allocated budget and limited excesses will be entertained or tolerated, whilst care to be exercised not to compromise the safety standards of the company. The cost factor must be contained and reduced and end to end processes should focus more on preventative maintenance to improve availability and drive maintenance cost down over any given period. The reactive maintenance approach and strategy methodology are evident from the plant's historical availability, reliability and maintenance (AMIP) assessment. Pragma Africa (Pty) Ltd completed the first AMIP assessment during 2009, with annual assessments thereafter. The conclusion from these assessments confirmed that the company needed to improve on its existing maintenance program.

- Poor machine availability 50% – 60%
- No root cause analysis on equipment failures
- High amount of outsourced work
- Very low schedule return
- Very low quality of returned schedules
- One line breakdown reporting strictly for availability purposes
- Some Teams have no work area's
- High spares usage
- Very low repair spares return
- Poor quality work was identified at some locations
- High waste and scattered all over site
- No SLA's with internal customers
- Low skill usage
- No preventative maintenance measures
- Delaying critical shutdown maintenance
- No critical part and risk analysis
- Low job card use and return
- Poor management processes

Motivation on all levels of the production employees are low due to a recent restructuring and reduction in the human resources. It will therefore be a critical requirement to implement human resource interventions and programs to re-affirm the trust factor and the importance of team cohesion who embraces the company vision and mission. This intervention must include the:

- Current level of motivation;
- Analyse the current work schedule in terms of short to medium requirements, i.e. contracts, production volumes, piping requirements, etc.;
- The company strategy, vision and mission statements;
- Indicative production volumes required for the next 12 months;
- Skills analyses of the current production team and whether this asset will be nurtured and enhanced, or whether further retrenchments will be contemplated if the production volumes are not increased (Clear guidelines required); and
- The company's long term strategy and why it is important for employees to remain with the company.

The current maintenance function is a decentralised business unit with no dedicated workshops. It is represented by service areas within some production line areas. This will expose employees to possible negative sentiments and outside forces, which could lead to increased workforce turnaround and low levels of work satisfaction. An employee needs to have a dedicated area which he can define as his own and take pride in.

This current decentralised approach lacks an approved rotation program for artisans, which limits the ability of the artisan to improve their own skills base. Cross pollination of skills between the various skilled individuals are severely hampered by this method to the detriment of the individuals and the company. The lack of proper development programs can also be considered as a limitation to the artisans, who is only working on pre-determined machines or sections.

One of the positives of a decentralised approach is that artisans can become experts on certain machines, but limits their general machine and maintenance understanding. This is excellent for the company in a highly specialised technical plant where technical experts are required, but it severely limits the positives of cross pollination and centralised knowledge hosed in these individuals. This could make the company vulnerable if the experts leave the trade or opt to work for the competition.

A quality maintenance team is highly dependent on the management ability to identify "future talent" amongst apprentices and promoting the existent talent pool of people. There are currently limited development opportunities for the apprentices, which might leave the company vulnerable when these young artisans qualify. Losing newly qualified talent will increase the risk for the company as theses artisans have already become experts in their respective fields of expertise at the company. The lack of long term career planning will have a direct effect on the future of this maintenance group.

Reliability Centred Maintenance (RCM) must be an integral part of the company's long term strategy and maintenance program. This must further be supported by a fully operational RCM system within the medium term. The company systems are currently operating on an On Key CMMS system which manages the assets of the company electronically. This is however insufficient due to the fact that only basic data is captured at a schedule attainment of 20% and an estimated schedule quality of 50%.The outcome is a function of the input and dependant on the quality of the data captured - the current output indicates a lack of preventative and quality maintenance. This is further exacerbated by the low level of involvement in preventative maintenance. Future reporting of possible breakdowns must be

recorded and is currently available in a scheduled format. This could place the integrity of the functioning of the maintenance team in question. This could cast doubt on the integrity of the Statutory reporting schedules which could influence the companies' legal compliance, including the company's responsibility towards health and safety of its employees.

Maintenance Analysis

This analysis will identify critical challenges, areas of concern, solutions and opportunities in the company's maintenance program. Interactive discussions can be used as a valuable tool to obtain information. Conducting a friendly and informal discussion by a trusted employee will enhance the honesty of the responses; trust level were also analysed during these discussions.

Questions were well researched to cover the full spectrum of the maintenance program. The questions were formulated in such a way not to provide the participant with leading answers. Employees were encouraged to utilised this opportunity to improve the current maintenance methodology with their open views, opinions and ideals. The sample group was large enough in order for all levels to contribute. This will give credibility to the study and any comments were permit to enable the facilitator to form an informed opinion of the sentiments, ideas, solutions and opportunities of the participant.

The diversity of the group interviewed provides comfort that all critical opinions were recorded and included in the output / result. The group interviewed (sample) was fairly represented from all areas, i.e. production, logistics and stores, maintenance etc. Participants will be able to evaluate the successes of the existing maintenance teams on an on-going basis, including the value add of the management team.

The investigation started by interviewing the maintenance and production teams on different levels of authority. All interviews were conducted by the maintenance engineer and maintenance planner. The interviews were limited to a small randomly selected group of 2 to 3 due to the risk of the perception of intimidation which might exist if the interviews were one-on-one. The planning office is a familiar location for all production and maintenance employees which created neutral conditions for this type of interviews. The intimidation from the interviewer as a person or position was considered during the participant's group interview. The interviews were also conducted in such a way that no personal opinions or views were shared with the participants. This eradicates the possible anomalies and patterns which could develop if not controlled. (Cooper, 2006, p. 364)

Questions were formulated to guide the participant to analyse the company from a holistic perspective, with emphasis on the maintenance requirements. Questions were carefully designed to ensure honesty with checks and balances put in place. Participants were encouraged to provide honest answers to permit the company to utilise the responses to formulate a strategy for the wellbeing of all. The groups were interactive and responded well to the questioning. (Cooper, 2006, p. 365).

The questionnaire comprised of 24 strategic questions towards this maintenance investigation backed by the hypothesis and the initial assessment of the current state of maintenance. The purpose of the questionnaire structure was to identify the areas of concern supported by the data obtained. It should be noted that the diversity of the

participants will provide wide ranging responses based on the work experience, skill level, personality and willingness to participate.

1	Rate the **quality of maintenance** work
2	Rate the positive **culture of the maintenance** group
3	Rate the amount of substandard work from competent **maintenance people** (Negative)
4	Rate the possibility of employees involved with **theft and/or sabotage** (Negative) (Company)
5	Rate the **overuse of specific suppliers** (Negative)(Company)
6	Rate the relationship between **maintenance and stores**
7	Rate the amount of **waste regarding recycling** (Negative) (Company)
8	Rate the **level of motivation** amongst the maintenance group
9	Rate the **level of discipline** used in maintenance department
10	Rate the maintenance **interest in safety** and safe working procedures
11	Rate the maintenance **interest in schedules and job cards**
12	Rate the **knowledge of processes and procedures** maintenance employees have
13	Rate the relationship between **maintenance and production, projects**
14	Rate the effort from management to **improve maintenance employee skills**
15	Rate the possibility of employees involved with **corruption** (Negative)
16	Rate the usage of **Standard level Agreement** between business units
17	Rate the positive impact if **maintenance would be centralised,** 2 central workshops
18	Rate the **transparency of the company** (Company)
19	Rate the relationship between **maintenance and other sections of maintenance**
20	Rate the negative **impact of 2010 Retrenchments** (Negative) (Company)
21	Rate the impact of the **uncertain production future** on employees (Negative) (Company)
22	Rate the amount of maintenance **quick fixes** made around the plant (Negative)
23	Rate the interest in **breakdown reporting** and root cause analysis in maintenance
24	Rate the value of **restructuring** of the maintenance employees with more levels of authority

Table 1: Questionnaire and Indicators[19]

This questionnaire is supported by a "help sheet" to assist the facilitator when addressing the questions. It will assist the facilitator to evaluate the response to each question and record same in terms of a numerical value assigned to it – numerical transformation will be ventilated later in the chapter.

(Negative Responses): This will be the questions which are posed in the form of a negative statement. The outcome (numbers) will be the same reflection of the number range used for all questions to ensure that low numbers in the matrix reflects negative reaction and high numbers positive reaction.

(Company Indicator): Questions are directly related to the general company and not addressing the maintenance specific area of responsibility (top management requested this information from the study). The risk of criminal / unacceptable behaviour (i.e. theft) focuses on all areas, not just maintenance.

The participant's responses were evaluated against the participant's sentiments towards the study, level of knowledge, position in the manufacturing chain and the participant's application of mind. Results were calibrated in view of the group. This was also integrated with the level of comfort in communication and the willingness to share information and or suggestions with the interviewers. (Cooper, 2006, p. 367).

[19] Extract of Appendix A

Interviewers are familiar with the various business units and locations of the participants including the extent of their willingness to easily interact within the maintenance team. The responses were captured during the interview and the facilitator's indicators are detailed below. To ensure that the responses provide a high quality output the following evaluation table was used.

	Nothing	No Interest	Negative	Done	Interested	
Maintenance Knowledge	0%	25%	50%	75%	100%	Objective view
Thought through on the topic	0%	25%	50%	75%	100%	Quality
Clarity of the communication	0%	25%	50%	75%	100%	Quality
Ease in communication with participant	0%	25%	50%	75%	100%	Quality
Motivation to share	0%	25%	50%	75%	100%	Quality

Table 2: Quality Evaluation[20]

The principle applied if a participant scored below 50% for any question, that it be discarded as this could negatively influence the scoring reliability. Overall this exclusion will assist the results to strive to the norm but will not negatively influence the sample outcome because of the sample size. The maximum possible and excluded less than 5% will statistically not influence the value drop. There is higher value in quality response than quantity response.

Quality of Interview					
100%	100%	100%	100%	100%	100%
75%	100%	100%	100%	100%	75%
75%	75%	100%	100%	100%	56%
75%	75%	75%	100%	100%	42%
75%	75%	75%	75%	100%	32%
75%	75%	75%	75%	75%	24%

Table 3: Table of Quality Calculation[21]

The values of 100% to 24% will not be used in calculations or any data other than visually illustrating the quality of evaluation. The result percentages are also just an illustration of decrease and not an actual representation to another participant that would be 100%.

Information processing

The facilitators based their interpretations in respect of the quality of the participant's responses, by evaluating external subjective criteria, i.e. body language, attitude displayed towards the study and the application of mind in responding to more difficult questions. The quality assumption of the facilitator can be defined by the value assigned to the participants input as shown above.

The challenge is that there is no scientific methodology to eradicate personal perceptions or subjective criteria of the facilitators to express their own assumptions from the responses of each participant. The value of the response strategy is to prevent the interviewers to create a hypothesis on the quality of the interview, but still reflects the facts as required. Information

[20] Extract of Appendix B
[21] Extract of Appendix B

from the facilitators requires proper processing as illustrated in the subsection - calculating information.

Indirect Information

The participant's responses assist the facilitators to complete the quality evaluation with relative ease. Due to the degree of difficulty, some of the questions received a low quality response than others, but facilitators explained questions to all participants.

Question 3 created the thinking that the interviewers were trying to lead the participants into certain responses, but guidance was supplied during interview. It was explained that it's not about the substandard work of all maintenance work done, but rather the amount of substandard jobs done due to external pressures forcing competent employees to use shortcuts.

Question 4 caused some confusion for management regarding the "Theft and Sabotage scenario" but the emphasis was on the key word "*possibility of being involved"* in such acts not the physical acts itself.

Question 17: The uncertainty regarding question 17 was explained to the participants as centralisation plans are being considered, which could possibly be on two different locations. Considerations could be a main workshop and a support centre to the further plants and a centralised store for long lead time spares for repairs and breakdowns.

Question 24 required a brief discussion on the potential changes with a restructuring program before the desired quality responses could be achieved. This would include more levels of report and responsibility as well as larger support structure. No structure was discussed.

A sample of 39 employees was interviewed out of a total size of 41 possible employees. The sample was reduced by two employees due to absence from work. All participants were evaluated according to Table 2: Quality Evaluation and results are displayed in Figure 4: Scoring Table below. All related departments and employees were considered for this evaluation and all participated as mentioned above.

Number of interviews	39	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Maint. Management / Prod. Management / Maint. Artisan	Name And surname	Mpumi Vtambo	Devan Vosloo	Gert Strydom	Johan Marx	Deon Pretorius	Koos Taljaart	Don Grey	Hans Venter	Fanie Mkuwana	Bheki Ngosha	Vusimusi Khuswayo	Themba Masuku	Cyril Maseko	Elias Lerata	Marlon Franke	Koos Baaltjies	Jeffery Ngema	Dewald de Kock	William Mmela	Edward Rasasheane	Oupa Morobi	Jabhile Morea	Sarel Kombrink	Kennith Mkhwanzi	Carl Smith	Lucian Mitrea	Theodore Tailer	Zama
Knowledge		0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	0.75	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	0.75	0.75	1.00	0.75	0.75	1.00
Thought through		1.00	1.00	1.00	0.75	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00
Communication Clarity		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Communication Ease		1.00	1.00	0.75	1.00	0.75	0.75	1.00	1.00	1.00	0.75	0.75	1.00	1.00	1.00	1.00	0.75	0.75	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	0.75	1.00	1.00
Motivation to share		1.00	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
		75%	100%	56%	56%	56%	56%	100%	75%	100%	75%	75%	56%	100%	56%	100%	56%	75%	75%	100%	56%	75%	75%	75%	75%	100%	56%	56%	100%

Figure 4: Scoring Table [22]

[22] Exstract of Appendix D

The scoring per individual can be calculated by **Table 3: Table of Quality Calculation** and results are displayed in **Figure 4: Scoring Table** above. These results are summarised and equated to the final conclusion that the process was understood and responses met the desired level of understanding. The feedback from all the participants was that all understood the process and the communication between the participants and the facilitator was of a good standard. Knowledge and insight into the process were at acceptable levels due to the group's daily involvement in the maintenance function. There were some cases where employees did not have a direct involvement to a specific area to respond to a question, which might slightly influence the overall percentage, but this was carefully monitored. Participant expressed real interest in the study and asked leading questions around the purpose and outcome of this analysis.

Interpretation of the body language assisted facilitators with application of mind used by the participants when responding to questions. It was obvious that certain questions caused discomfort by the participants and responses were qualified. Application of mind was used in measuring the response time to questions as well as the overall behaviour displayed in responding to questions. Some participants were not as responsive as other participants and a small group were reluctant to elaborate outside the short answers given, forcing the process. Table 4 is therefore not an actual value expression, but rather an evaluation tool providing insights into the inputs of the group.

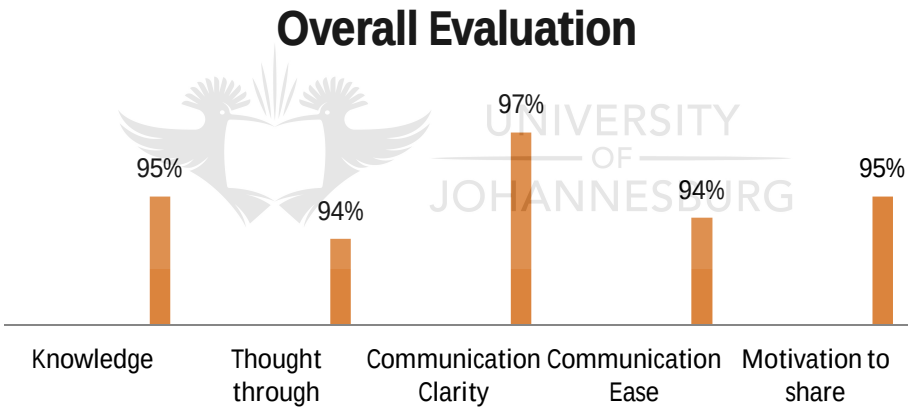


Table 4: Group Input Evaluation

Calculating Information

Matrix

Each question and name was included into a calculation matrix as shown in appendix D. This shows the participants responses to individual questions related to others. The following can be derived from same. The total average of the responses would be the total input by the group per responses divided by the group size "n".

$$\text{Question Average} = \frac{\text{Input}}{n} = \frac{\sum_{k=1}^{n} x}{n}$$

Equation 1: Question Average

The question (response) average will equate into a sensitivity level according to the range as explained in **Table 5: Sensitivity level and rating** below. The principal of a high number means excellent and a low number indicates a challenge or attention needed. This will assist

with the final evaluation as all answers must be calibrated to the standard of low range (challenges) and high range (positive reaction).

Answers in the range of 1.75 to 2.75 will be an area of concern and the main focus will be to address these challenges. There will be some concerns if the quality and ethics responses depicts a lower than neutral rating.

1.75 < x < 2.25	Damaging
2.25< x < 2.75	Problems
2.75 < x < 3. 25	Neutral
3.25 < x < 3.75	Good
3.75< x< 4.25	Excellent

Table 5: Sensitivity level and rating

The sensitivity level of each question will be evaluated against the sensitivity analysis rating and certain questions have had neutral responses. Using question 10 (which relates to safety in the factory) will illustrate that a result of 3 will be a neutral response, but the safety rating should always be higher at 4 as safety precautions are never negotiable.

Results

The overall results graph will indicate an average for each response, calculated over the entire group. The results per question are calculated according to **Equation 1: Question Average**. The sensitivity level will be discussed per question and outcomes because of the result. Comparisons between departments and levels in structure are evaluated and highlight key differences. It should also be taken into account that the group sizes differ between departments and the size of the artisan group (larger) against the management group. Stronger opinions are easier reflected in smaller groups and can lose significance in large samples. Due to the differential in group sizes, sample groups were also evaluated according to their location.

Deviations to questions are illustrated graphically between groups and discussed. Questions with a high rating “1” or “5” was calculated as a strong opinion response and the differences in opinions were also considered with a high “1” and high “5” rating. The decentralised groups were evaluated against each other to identify whether the stronger opinions are not confided to smaller areas.

Question1: Rate the quality of maintenance work.

Group Rating	3.30
Maintenance Management	3.25
Maintenance Artisans	3.40
Production Management	3.27
Largest Deviation	0.15

Table 6: Question 1 Results

The deviation of 0.15 clearly indicates similarity in responses. The rating of 3.3 places group in a “good” category according to the sensitivity level measurement. From a decentralised point of view this should have been substantially higher because there is constant supervision of the function and limited variations of skills. The dynamics of this question can

be influenced by the quality of skills and/or the pressure to produce products and/or the willingness to accept substandard quality and/or the budget constraints.

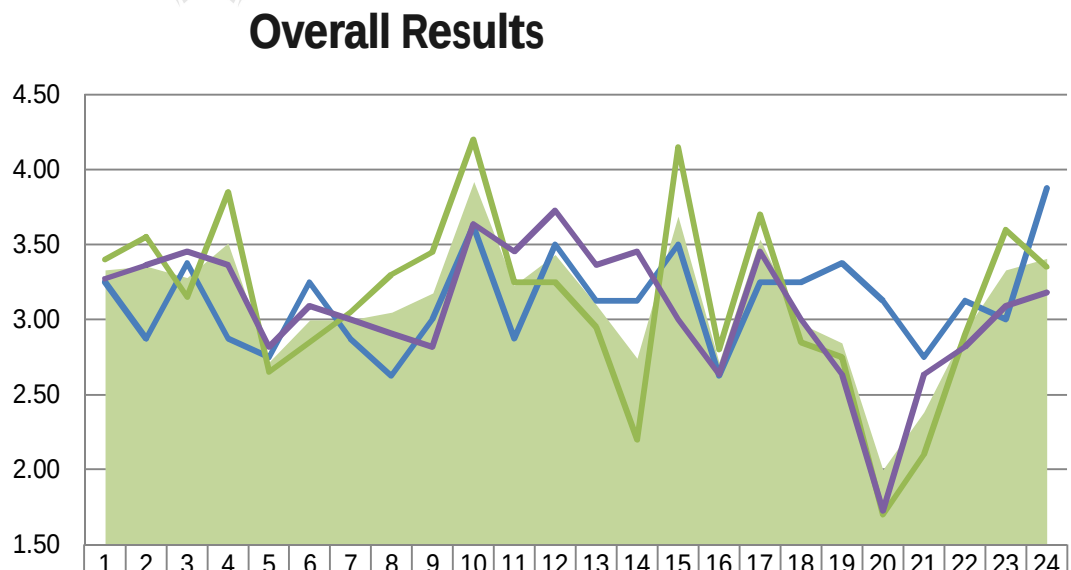
This will cause an inability to remedy the problem and/or improve the availability of skills and/or the availability of spares and equipment and/or the quality of equipment or equipment overall. There should be a strong focus on skills development and training to improve maintenance quality and skills over a wider range of equipment. The remaining questions will address some of the other issues.

Question 2: Rate the positive culture of the maintenance group.

Group Rating	3.36
Maintenance Management	2.88
Maintenance Artisans	3.55
Production Management	3.36
Largest Deviation	0.68

Table 7: Question 2 Results

The medium deviation of 0.68 between maintenance management and maintenance artisans shows some lack of cohesion between the two levels of employees. Maintenance management and artisans are expected to communicate as a single voice and production should be the stronger deviation. Overall a positive response (higher value) was expected, but due to the substantial deviation the value neutralises itself. The rating 3.36 places the overall group in a "good" sensitivity level category. The major underlined issue is the difference in perceptions of "maintenance culture" between management and the rest of the artisan's team. This would obviously the larger size of the group and would reflect more the artisans than the maintenance.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Group Average	3.3	3.3	3.2	3.5	2.7	3.0	3.0	3.0	3.1	3.9	3.2	3.4	3.1	2.7	3.6	2.7	3.5	2.9	2.8	2.0	2.3	2.9	3.3	3.4
Maint Management	3.2	2.8	3.3	2.8	2.7	3.2	2.8	2.6	3.0	3.6	2.8	3.5	3.1	3.1	3.5	2.6	3.2	3.2	3.3	3.1	2.7	3.1	3.0	3.8
Maint. Artisans	3.4	3.5	3.1	3.8	2.6	2.8	3.0	3.3	3.4	4.2	3.2	3.2	2.9	2.2	4.1	2.8	3.7	2.8	2.7	1.7	2.1	2.9	3.6	3.3
Production Management	3.2	3.3	3.4	3.3	2.8	3.0	3.0	2.9	2.8	3.6	3.4	3.7	3.3	3.4	3.0	2.6	3.4	3.0	2.6	1.7	2.6	2.8	3.0	3.1

Figure 5: Overall Results Graph
Table 8: Overall Results Table

Management does not support the view that the maintenance culture is as strong as artisan's team. The deviation is very moderate but could not be ignored. The challenge for some of the artisans lies in their inability to fully understand the complex measuring criteria of the management structure. A possible reaction of fight/flight/freeze could influences the artisans group defending their pride and culture. Artisans are also responding from the groups comfort zone where the unit is much smaller than the overall group. The management obviously has a more holistic view and identify other dynamics in the artisans group. It could also be derived that there is a strong maintenance culture and pride within the section and sharing information outside this unit creates its own difficulties.

Question 3: Rate the amount of substandard work from competent maintenance resources.

Group Rating	3.28
Maintenance Management	3.38
Maintenance Artisans	3.15
Production Management	3.45
Largest Deviation	0.3

Table 9: Question 3 Results

The deviation of 0.3 shows a higher deviation than 0.15 deviations to questions 1, but still an overall negligible deviation. The variance between question one and three was quality performance versus volume achieved which attributed to substandard operations. The two questions focused on different areas of quality, where substandard work will focus on substandard quality as well as the amount / volume in repairs by individuals or groups. A typical example of this is work performed under pressure due to time and manufacturing, constraints or when spares are not available, etc.

The rating of 3.28 places the group in the "good" category rating according to the sensitivity level measurement. It is noticeable that the artisans are more critical regarding their own "substandard work" than the management teams. This clearly indicates that the artisans are not threatened by the process and that the team are willing to be open and honest to be critical whilst management are more supportive than perceived by the unit and/or oblivious of the substandard works in the unit. This question will also interface with the evaluation of question 1.

Question 4: Rate the possibility of employees being involved in criminal activity, i.e. theft or sabotage.

Group Rating	3.51
Maintenance Management	2.88
Maintenance Artisans	3.85
Production Management	3.36
Largest Deviation	0.98

Table 10: Question 4 Results

A deviation of 0.98 was recorded and this clearly illustrates a major deviation in the perception of the individuals interviewed. This responses to the question indicated that 28% of the group expressed a strong rating of "5" to the question. Conversely to this, 1% of the group expressed a strong opinion of "1" dealing with the possibility of theft and sabotage. The expectation was that this question would create some strong opinions, but at the lower

end of the scale, i.e. a rating level of “1” or “2”. This might indicate that there are challenges to address. The 1% low rating was expressed from the management group and it is obvious that this might be an isolated issue, which we can address of an afterwards basis.

The biggest discrepancy is amongst the maintenance artisans and management – artisans versus management. Artisans might not understand the intricacies and cost implications of managing the spare stores, equipment and other ancillary expenses, hence the difference of perceptions. The management rating of 2.88 still has a sensitivity level of “neutral” although a need exists to consider additional control measures in dealing with this cost factor. This is in contrast with Question 1 where the culture is rated relatively high by all participants, although individuals might be involved in unethical behaviour. Management might suspect some unethical activity, but are reluctant to express an opinion without substantiating facts. This was mentioned during some of the interviews.

Question 5: Rate the overuse of specific suppliers.

Group Rating	2.72
Maintenance Management	2.75
Maintenance Artisans	2.65
Production Management	2.82
Largest Deviation	0.17

Table 11: Question 5 Results

The small deviation of 0.17 clearly shows that the group agrees that there is an overuse of certain suppliers. This scenario equates to a “challenge” as depicted in sensitivity level analysis and will have to be addressed as a matter of urgency. The overuse of supplier is caused by the supplier’s good service record in delivering the products in the shortest possible time, but not necessarily at the best price. This is known to the suppliers and can be exploited due to their standardised approach and short lead times.

This leaves the company vulnerable to exploitation when the supplier realises this dependency. The maintenances unit should draw their equipment and stock from a centralised store and only use outside contractors for specialised services, i.e. crane services. Lead times on breakdowns are costly and it is important that we find equilibrium between what is needed on a continuous basis and what should be sourced from suppliers at short notice.

The interface between the needs of the unit, what is available from an in-house store and what needs to be sourced from outside the company is an art on its own and competent and dedicated buyers should for fill this function, especially in view of the high cost of some of the spares, consumables and contractors. A cost benefit analysis should be done to determine the viability of such a function and to what level this function must be funded internally.

It is further suggested that specialised skills be contracted in advance using service level agreements to monitor their performance. The service level agreements need to be approved in advance at a management level to ensure a meeting of minds of the expectations of the suppliers, whether in house or external. This process will need bi annual reviews to ensure efficacy of all involved.

Question 6: Rate the relationship between the maintenance unit and the maintenance stores.

Group Rating	3.00
Maintenance Management	3.25
Maintenance Artisans	2.85
Production Management	3.09
Largest Deviation	0.40

Table 12: Question 6 Results

A small deviation of 0.40 was recorded indicating the difference of opinion between maintenance management and artisans. The deviation indicates that artisans are of the opinion that room exist for improvement of this function and this is based on their daily activities with the stores. The perception should be discussed with the stores managers and identify problems areas, i.e. relationship and/or stockholding. The availability of spares / consumables was discussed, including the wastage of consumable stock. Delivery delays experienced due to transport issues were also identified as a possible problem area. The responses were rated as neutral and the rating confirms complacency, although an improvement in the efficacy of the store system can result in exponential improvements.

Question 7: Rate the volume of wastage relating recycling.

Group Rating	3.00
Maintenance Management	2.88
Maintenance Artisans	3.05
Production Management	3.00
Largest Deviation	0.18

Table 13: Question 7 Results

A deviation of 0.18 indicates a meeting of minds in the sample group. The maintenance management team believes there is room for improvement, although the overall answer reflects a “neutral” sensitivity level category. Recycle programs are currently limited to skip bins and waste material dustbins. The efficacy of this program can improve with more bins and more stringent rules regulating this resource. Production is a major waste producer, followed by the maintenance unit.

Improved controls and more facilities will increase the efficacy of this function which could result in a reduction in the carbon footprint for the company. A revision of the company’s waste disposal policy, supported by a program to change the current low levels of involvement, will improve the individuals’ view towards this important issue – improving management might yield a return to assist in covering some of the costs.

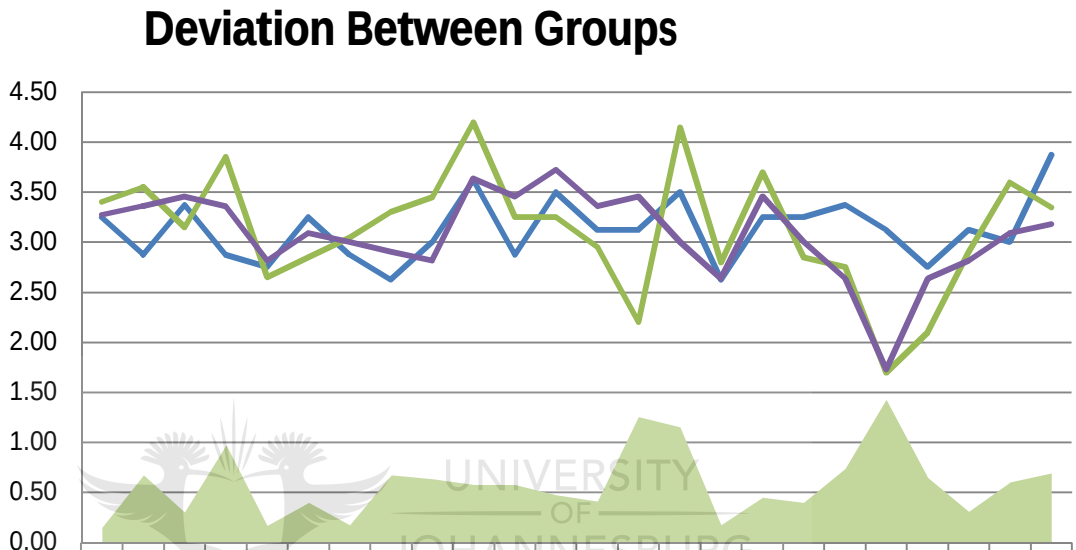
Question 8: Rate the level of motivation of the maintenance unit.

Group Rating	3.05
Maintenance Management	2.63
Maintenance Artisans	3.30
Production Management	2.91
Largest Deviation	0.68

Table 14: Question 8 Results

Deviation rating of 0.68 shows that there is a moderate degree of difference between the groups. Maintenance artisans indicated a higher motivation level if compared to the other groups. This clearly indicates that the artisans' team are motivated, but this perception is not shared by the management team. The sensitivity rating of 3.05 is "neutral" although we expected higher rating to the strong team culture of the group as mentioned in Question 2.

Management substantiate the rationale for the lower rating by highlighting the lack of urgency when breakdowns are experienced, neglecting toolboxes on call outs, reluctance liaise with the production operators during and after the shift ends. A quick fix will be to address adherence to approved procedure and to adopt a more stringent approach to these transgressions.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Largest Deviation	0.1	0.6	0.3	0.9	0.1	0.4	0.1	0.6	0.6	0.5	0.5	0.4	0.4	1.2	1.1	0.1	0.4	0.4	0.7	1.4	0.6	0.3	0.6	0.6
Maint Mananagement	3.2	2.8	3.3	2.8	2.7	3.2	2.8	2.6	3.0	3.6	2.8	3.5	3.1	3.1	3.5	2.6	3.2	3.2	3.3	3.1	2.7	3.1	3.0	3.8
Maint. Artisans	3.4	3.5	3.1	3.8	2.6	2.8	3.0	3.3	3.4	4.2	3.2	3.2	2.9	2.2	4.1	2.8	3.7	2.8	2.7	1.7	2.1	2.9	3.6	3.3
Production Man	3.2	3.3	3.4	3.3	2.8	3.0	3.0	2.9	2.8	3.6	3.4	3.7	3.3	3.4	3.0	2.6	3.4	3.0	2.6	1.7	2.6	2.8	3.0	3.1

Figure 6: Maximum Deviation Graph
Table 15: Maximum Deviation Table

Question 9: Rate the level of discipline used in the maintenance unit.

Group Rating	3.18
Maintenance Management	3.00
Maintenance Artisans	3.45
Production Management	2.82
Largest Deviation	0.63

Table 16: Question 9 Results

A moderate deviation of 0.63 was the result of the production team giving a lower rating. Artisans, ones again express a strong opinion on discipline being enforced, but this is not fully reflected in their scores. This indicates that discipline needs more emphasis and this questions the management team's willingness to accept the current position. The maintenance team is willing to accept that there is room for improvement, whilst the production team's group reflects scores on the lower end of the rating. It is obvious that

management needs to re-address adherence to policies and procedures to improve the general adherence to discipline.

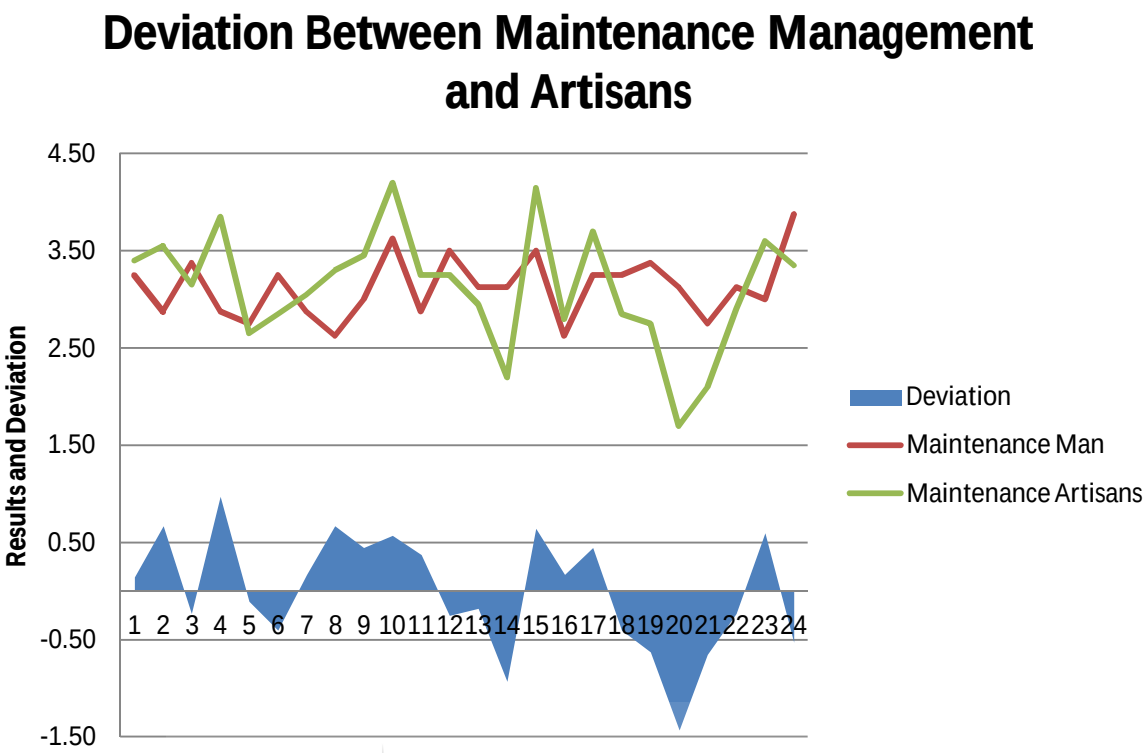


Figure 7: Deviation between Maintenance Management and Artisans

Question 10: Rate the maintenance interest in safety and safe working procedures.

Group Rating	3.92
Maintenance Management	3.63
Maintenance Artisans	4.20
Production Management	3.64
Largest Deviation	0.58

Table 17: Question 10 Results

A moderate deviation of 0.58 indicates that the production management team believes the safety could improve to a more satisfactory level. The overall rating indicates that the group values safety and safety procedures, which is an important characteristic for a maintenance unit.

Question 11: Rate the maintenance interest in schedules and job cards.

Group Rating	3.23
Maintenance Management	2.88
Maintenance Artisans	3.25
Production Management	3.45
Largest Deviation	0.58

Table 18: Question 11 Results

The deviation of 0.58 shows a moderate deviation between production and maintenance management. The production management believes that the paperwork for the manufacturing plants is done during normal monitoring and breakdowns, but is not aware of

the processes behind same where stats are reviewed and discussed on a weekly basis. This could be the reason for the moderate deviation, but the efficacy of this maintenance program needs to improve as only 20% of all maintenance schedules are submitted regularly.

Question 12: Rate the knowledge of processes and procedures maintenance employees have.

Group Rating	3.44
Maintenance Management	3.50
Maintenance Artisans	3.25
Production Management	3.73
Largest Deviation	0.48

Table 19: Question 12 Results

A small deviation of 0.48 was recorded to this question illustrating small differences in perceptions. The rating is high and substantiates the perception that individuals are fully aware of what they are expected to do. The swing to a positive deviation was not expected, but the artisans are aware of the processes and procedures and will benefit reaffirming it on a more frequent basis. Training on a more regular basis will improve this even more.

Question 13: Rate the relationship between maintenance and production.

Group Rating	3.10
Maintenance Management	3.13
Maintenance Artisans	2.95
Production Management	3.36
Largest Deviation	0.41

Table 20: Question 13 Results

The responses to this question have a low deviation of 0.41 which points out that the relationship is neutral, which could be perceived as a negative response. The aim for the maintenance unit will always be to have a strong relationship with the production team due to their intra and inter dependence. From the rating it's clear that production has a more positive perception on the relationship and this could be that the sample number is smaller or that the overall opinion is neutral. Artisans show a slightly lower but neutral answer towards the relationship. This could be as a result of production that has a higher expectation than what the artisans are expect to deliver.

Question 14: Rate the effort from management to improve maintenance employee skills.

Group Rating	2.74
Maintenance Management	3.13
Maintenance Artisans	2.20
Production Management	3.45
Largest Deviation	1.25

Table 21: Question 14 Results

A recorded deviation of 1.25 indicates a high concern for the improvement of skills. This question was clearly focused on artisan's development and skills and the outcome was extreme. There is a clear difference in perceptions of what is required by the various parties

and this could relate to the artisans expectations from undertakings given by the management team regarding future training.

Feedback from the facilitators indicates that artisans are expected to perform duties above their skills level and training provided, i.e. repairs are performed without drawings, parts lists, diagrams and study material relating to their maintenance function. The team is also expected to be trained from an apprentice's to artisan level and delays experienced in this process are perceived to be caused by management.

Budget limitations are perceived as a reluctance to spend money on training and this created a perception that the artisan team is not valued. Regular feedback could soften the sentiments and improve this perception. Proper planning and training schedules will deal with the uncertainty, which will result in a better understanding by all parties concerned. Processes and procedural training can also form part this training plan.

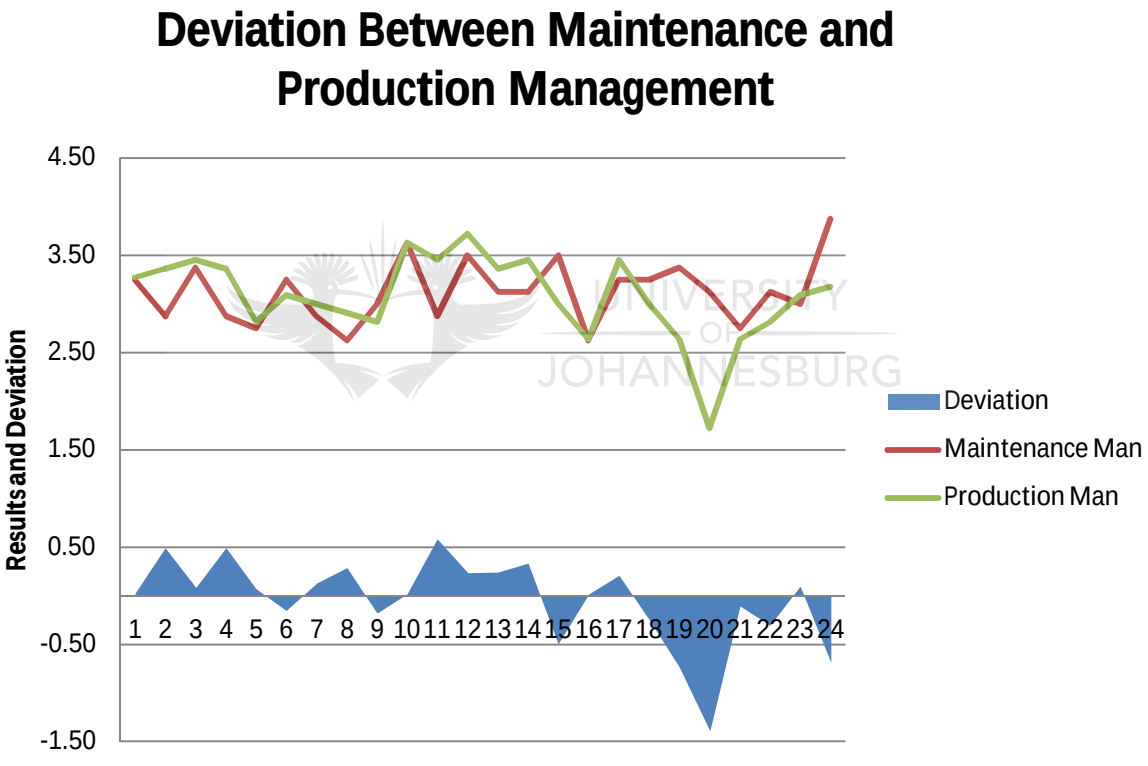


Figure 8: Maximum Deviation Graph

Question 15: Rate the possibility of employees involved in corruption.

Group Rating	3.69
Maintenance Management	3.50
Maintenance Artisans	4.15
Production Management	3.00
Largest Deviation	1.15

Table 22: Question 15 Results

The group rating of 3.69 indicates a strong believe that there is a low to no levels of corruption prevalent. There is an anomaly in that the 1.15 deviation is perceived by 3 individuals who identified unethical behaviour as a possibility and shared some information

regarding their concerns – the participants were not requested to provide substantiating proof to this effect.

The Production team's value was on the lower end of the scale, but a "3" rating still indicates a neutral answer – not really expressing an opinion. Overall the artisans expressed strong sentiments towards the creation of an ethical group. The possibility of unacceptable behaviour by individuals will be investigated outside the scope of this analysis as it is imperative that the participant would experience the outcome of this investigation / analysis. The focus of this exercise will be to improve the processes and procedures to minimise the possibility of unethical behaviour.

Question 16: Rate the usage of Service Level Agreement between business units.

Group Rating	2.72
Maintenance Management	2.63
Maintenance Artisans	2.80
Production Management	2.64
Largest Deviation	0.18

Table 23: Question 16 Results

This is a negligible deviation of 0.18 and indicates the low level of understanding of the benefits of SLA's between departments and teams and the company and its outside suppliers and contractors. All the parties will have an understanding in place to govern the relationship and expectations of the outputs expected of each participant of such an agreement.

The communication and maintenance of the SLA is important to ensure that all parties adhere to the conditions of the agreement and deviations must trigger discussions. Critical criteria of the SLA and the team's ability to adhere to same must be monitored and communicated to all the parties on a continues basis – this will assist improving the relationship factual knowledge is shared between all parties to prevent incorrect perceptions being formed. The SLA will also cover the rules of engagement and processes and procedures strengthen the relationship and permit a strong cohesion between various departments.

Question 17: Rate the positive impact if the maintenance is centralised, e.g. 2 central workshops.

Group Rating	3.54
Maintenance Management	3.25
Maintenance Artisans	3.70
Production Management	3.45
Largest Deviation	0.45

Table 24: Question 17 Results

A moderate deviation of 0.45 indicates a meeting of minds by all concerned. The current teams lacked dedicated working areas / facilities and the sentiments of the group will improve substantially by providing same. The maintenance area will be a dedicated area with smaller areas / workstations spread over the plant. It is important to note that the manufacturing plant is spread over a linear distance of approximately 2.5km. This is a new

suggestion and groups clearly indicated a favourable disposition to this idea. Maintenance management was not as optimistic realising that the maintenance units prefer to operate as a unit and not to be integrated into other functions.

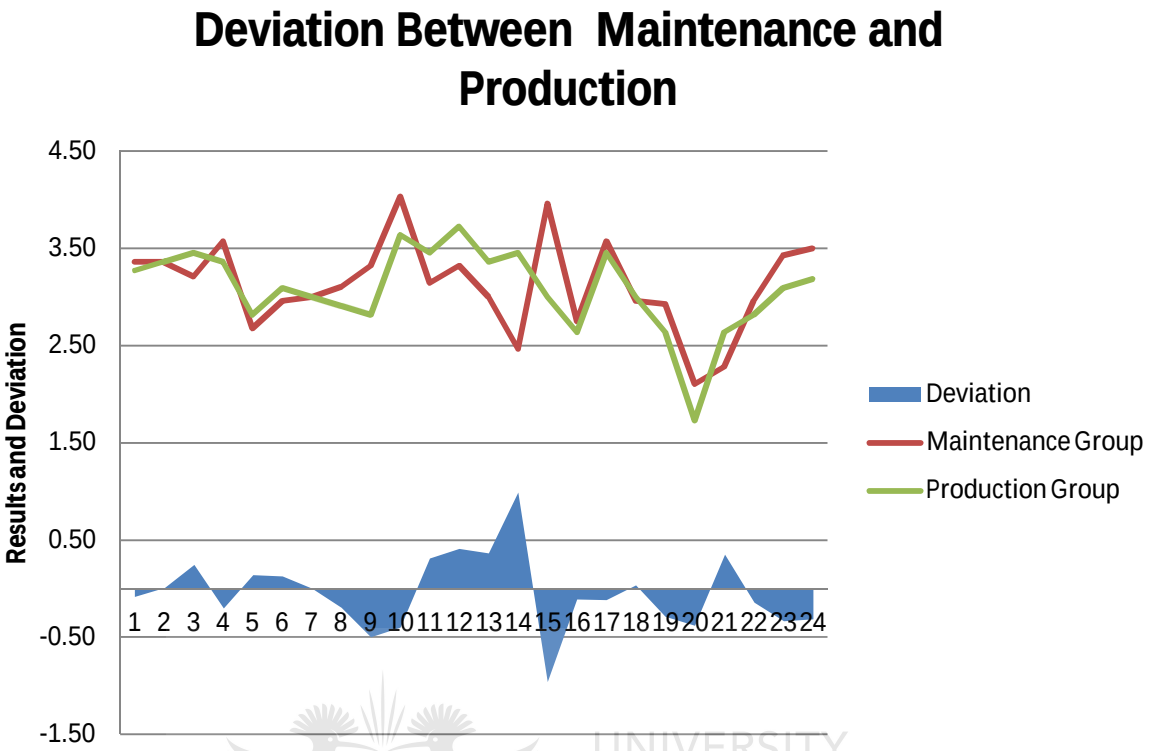


Figure 9: Maximum Deviation Graph

Question 18: Rate the transparency of the company.

Group Rating	2.97
Maintenance Management	3.25
Maintenance Artisans	2.85
Production Management	3.00
Largest Deviation	0.40

Table 25: Question 18 Results

Again a moderate deviation of 0.40 shows that the group believe the company's transparency methods are acceptable, yet on the low side – this could be attributed to the recent retrenchment programs implemented to improve the company's' profitability. Communication should be a high focus area for the new strategy and this should increase over time as the strategy is implemented.

Question 19: Rate the relationship between maintenance and other sections of maintenance.

Group Rating	2.85
Maintenance Management	3.38
Maintenance Artisans	2.75
Production Management	2.64
Largest Deviation	0.74

Table 26: Question 19 Results

The medium deviation of 0.74 was not expected, but the low group rating of 2.85 is concerning. Cognisance needs to be taken of the degree of difference between this rating and that of question two (3.36). The culture of the maintenance team is about inter and intra relationships in the entire maintenance chain.

Figure 10: Plant Locations vs. Group Deviations Clearly indicates that 4 groups bring the "working together" value down. The overall rating for production management was low with only one extreme problem group. This will be explained in more detail in Figure 10.

Question 20: Rate the negative impact of 2010 retrenchments.

Group Rating	2.00
Maintenance Management	3.13
Maintenance Artisans	1.70
Production Management	1.73
Largest Deviation	1.43

Table 27: Question 20 Results

The group indicates strong negative opinion on the impact of the 2010 retrenchments; however the management team is not as negatively inclined as the rest of the group. This overall rating of 2.00 is the lowest recorded result of the study. The deviation of 1.43 also creates the largest deviation recorded. This clearly indicates that there is a substantial difference in opinion about the effect of the retrenchments on individuals.

The maintenance management team's relatively high score could be attributed to the size of the sample as well as their perceptions. The clear difference of perception between management and the workers was expected as artisan's insight into the company is limited to their field of expertise whilst management have oversight over larger portions of the company. The lack of sufficient communication and transparency during the restructuring process attributed to these negative sentiments. There is a clear need for open and transparent communication.

Question 21: Rate the impact of the uncertain production future on employees.

Group Rating	2.38
Maintenance Management	2.75
Maintenance Artisans	2.10
Production Management	2.64
Largest Deviation	0.65

Table 28: Question 21 Results

The group's rating of 2.38 rates the production uncertainty as truly negative. The rationale for this negative approach could be as a result of the company's inability to secure sustainable long term contracts. This resulted in production time of the facility being reduce from a 24 hour continues shift (for a 3 year period) to the current 8 hours a day and 5 days a week with no increases in output required from the existing contracts.

This creates uncertainty under the employees and suppliers – this is further exacerbated by existing clients making use of alternative products, putting the overall business proposition at

risk. The medium deviation of 0.65 between maintenance management and the artisans is expected due to the management team's holistic view of the bigger group and company.

Question 22: Rate the amount of maintenance quick fixes made around the plant.

Group Rating	2.92
Maintenance Management	3.13
Maintenance Artisans	2.90
Production Management	2.82
Largest Deviation	0.31

Table 29: Question 22 Results

Low deviation of 0.31. The rating of 2.92 places group in a "neutral" position according to the sensitivity level rating. This rating is not about quality of the job performed but rather innovative but non standard practices. This clearly indicates an interrelation with questions 1 and 3.

Question 23: Rate the interest in breakdown reporting in maintenance.

Group Rating	3.33
Maintenance Management	3.00
Maintenance Artisans	3.60
Production Management	3.09
Largest Deviation	0.60

Table 30: Question 23 Results

The overall breakdown reporting indicates a deviation of 0.60 which is considered a medium rating. The artisans expressed stronger opinions compared to the maintenance management due to their interest in the activities, which forms part of their daily duties. Responses from the management team indicated a misalignment in the expectations of the parties in the sample group.

Management expect the current process also to include diagnostics of the breakdowns, including what preventative actions could be instituted to prevent same from happening in the future. Smaller breakdowns are not copiously recorded resulting in valuable maintenance records being lost - accumulative downtime are therefore not attributed to these small instances and might lose significance over time. The cost benefit will not keep track of these cost as it's is not recorded and same should be rectified.

Question 24: Rate the value of restructuring of the maintenance employees with more levels of authority.

Group Rating	3.41
Maintenance Management	3.88
Maintenance Artisans	3.35
Production Management	3.18
Largest Deviation	0.69

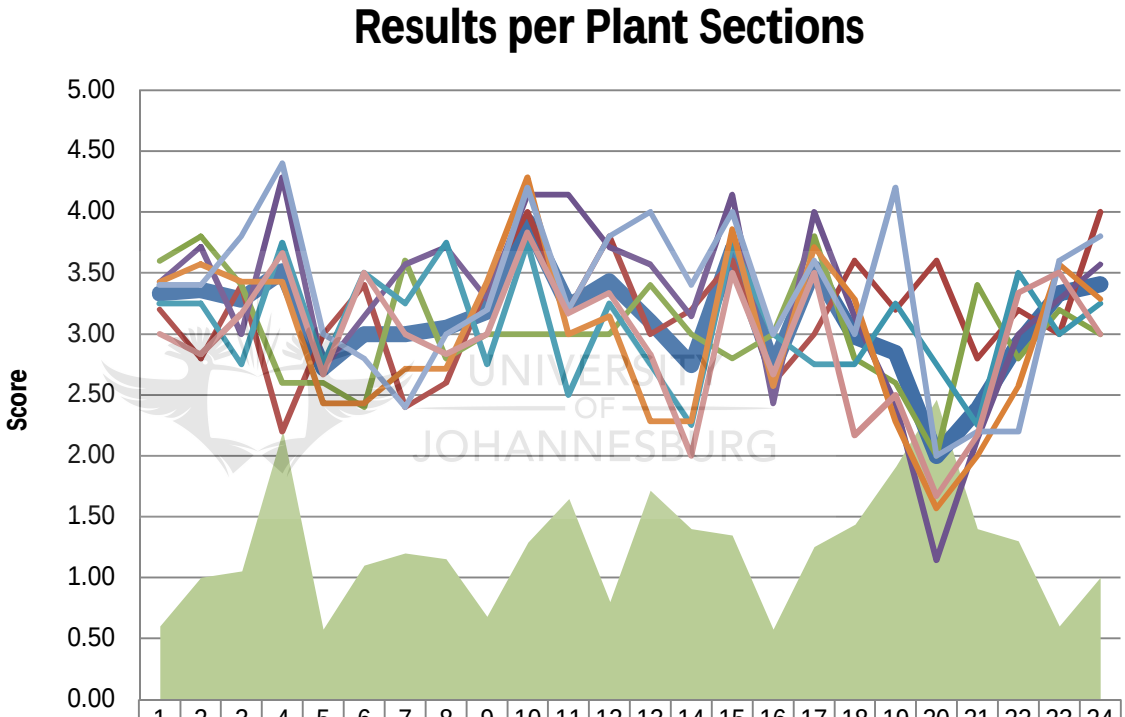
Table 31: Question 24 Results

A medium deviation of 0.69 was recorded with strong views from the maintenance management pushing towards a more hierarchical approach. The Production management rates this low, but indications are that they will accept the idea. The artisan's support this as

this can create promotion opportunities, whilst the production team's concerns relate more to the maintenance function at Wadeville than the structure.

The medium deviation indicates a meeting of minds amongst all groups that the restructuring of the maintenance unit will improve the overall perception of the function. It became evident from the interviews that nuance differences exist between the maintenance sections within the maintenance group. Some of the questions with strong differences were investigated for more clarity and the graph in **Figure 10: Plant Locations vs. Group Deviations** was used to display the difference of opinion between sections. **Figure 10: Plant Locations vs. Group Deviations**

Table 32: Plant Location Results displaces the result that shows the high deviations between sections.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Deviations	0.6	1.0	1.0	2.2	0.5	1.1	1.2	1.1	0.6	1.2	1.6	0.8	1.7	1.4	1.3	0.5	1.2	1.4	1.9	2.4	1.4	1.3	0.6	1.0
Group Average	3.3	3.3	3.2	3.5	2.7	3.0	3.0	3.0	3.1	3.9	3.2	3.4	3.1	2.7	3.6	2.7	3.5	2.9	2.8	2.0	2.3	2.9	3.3	3.4
Maintenance Management	3.2	2.8	3.4	2.2	3.0	3.4	2.4	2.6	3.4	4.0	3.2	3.8	3.0	3.2	3.6	2.6	3.0	3.6	3.2	3.6	2.8	3.2	3.0	4.0
3LC & Rap Plant	3.6	3.8	3.4	2.6	2.6	2.4	3.6	2.8	3.0	3.0	3.0	3.0	3.4	3.0	2.8	3.0	3.8	2.8	2.6	2.0	3.4	2.8	3.2	3.0
ERW Auxiliaries	3.4	3.7	3.0	4.2	2.7	3.1	3.5	3.7	3.2	4.1	4.1	3.7	3.5	3.1	4.1	2.4	4.0	3.1	2.4	1.1	2.1	3.0	3.2	3.5
Epoxy Line	3.2	3.2	2.7	3.7	2.7	3.5	3.2	3.7	2.7	3.7	2.5	3.2	2.7	2.2	3.7	3.0	2.7	2.7	3.2	2.7	2.2	3.5	3.0	3.2
Spiral Mill & Auxiliaries	3.4	3.5	3.4	3.4	2.4	2.4	2.7	2.7	3.4	4.2	3.0	3.1	2.2	2.2	3.8	2.5	3.7	3.2	2.2	1.5	2.0	2.5	3.5	3.2
Bandera Line	3.4	3.4	3.8	4.4	3.0	2.8	2.4	3.0	3.2	4.2	3.2	3.8	4.0	3.4	4.0	3.0	3.6	3.0	4.2	2.0	2.2	2.2	3.6	3.8
ERW Mill	3.0	2.8	3.1	3.6	2.6	3.5	3.0	2.8	3.0	3.8	3.1	3.3	2.8	2.0	3.5	2.6	3.5	2.1	2.5	1.6	2.1	3.3	3.5	3.0

Figure 10: Plant Locations vs. Group Deviations
Table 32: Plant Location Results (Appendix C)

The maintenance management and ERW mill group expressed some strong opinions on the culture in the maintenance unit compared to the rest of the group which regarded it as much

higher and stronger. Two sections in the maintenance unit illustrated some doubtful ethical behaviour despite the overall results indicating a low involvement in theft and sabotage. A similar response is reflected at the 3 layer coating plant regarding corruption, which will also be investigated outside the scope of the analysis. The two plants with the lowest rating are both located more than 2km away for the plant workshop.

This indicates that distance will affect the relationship and the management of the maintenance function. Feedback received during this process raised concerns regarding the safety procedures at the 3 Layer Coating and Rap Plants, which investigated outside the scope of this dissertation. The dissertation will focus on the sustainability strategy in the next chapter. Strong variations were found in discussing job cards and schedules which show that there is no influence between sections on preventative maintenance. This could easily be improved through proper communication and increased awareness.

The two sections reflected lower scores for the maintenance function and the relationship with the production team. This is a cause for concern and should be investigated. The team at ERW Mill has expressed strong opinions regarding their disappointment with the management team for not delivering on their promises relating to future training interventions. The epoxy line team is located in the middle of the two plants and centralisation will not have to a big an impact on them, hence their neutral response. The team at ERW Mill strongly doubt the company's transparency methods due to a lack of communication.

Direct Information

Maintenance Grouping – positive responses

- Centralising into one or two centralised workshops.
- Restructuring the maintenance team with more hierarchical levels. Individuals perceive that this will enhance training and development opportunities – will result in improved relationships between business owners.
- A strong interest is indicated in breakdown reporting, but there are no records to substantiate this.
- The quality of the maintenance team is rated high by the participants (subjective view), irrespective of the lack of comparable norms in the industry.
- The company / team culture in the maintenance team is rated as high. The culture rating is a function of the positive impact and sustainability of the maintenance culture, processes which are shared and embraced by all. (Cateora, 2008, p. 101) (This is an subjective view and could be the lack of knowledge)

Maintenance grouping – negative results:

- The 2010 retrenchments have had a very negative impact on all employees.
- The uncertainty regarding future production requirements creates unnecessary stress and this is further exacerbated by the negative sentiments carried as a burden from the previous retrenchments processes and the possibility of a similar exercise in the near future. This placed a further damper on the sentiments regarding the company's long term survival.
- Efforts from maintenance management to assist in improving the quality of the maintenance skills of individuals seem to be inadequate.

- Perceived nepotism towards certain suppliers (despite the three quote system), especially in view of the substandard service experienced during breakdowns outside working hours.
- Low level of understanding from the maintenance team regarding the utilisation and successes of service level agreements.

Maintenance Group – Full result:

- The acceptance by the management team of the low level of discipline in the maintenance team influenced the behaviour, culture and motivation within all levels in the team.
- The lack of proper control measures in respect of the quality maintenance functions will result in a tolerance level for substandard work and limited improvement in the quality of maintenance output.
- The levels of motivation within the maintenance group needs to be strengthen and boosted after the negative experiences caused by the retrenchments processes and the uncertainty in production volumes for the short to medium term.
- The impact of decentralised workshops on the motivation level of the team must not be underestimated as it impacts negatively on the quality of the output. The further lack of investments into the development of skills exacerbated this perception.
- The maintenance team needs to be restructured with more levels of authority to improve the customer focus functioning of the team. This will assist in improving the level of discipline and control over the group as well as enhancing the motivational levels of the individuals.
- A paradigm shift is needed in the managing team to bring the maintenance needs to international standards and focus on preventative and not breakdown maintenance.

Management viewed the questionnaires as time consuming and counterproductive. The perception is based on the presumption that participants will not be honest and the outcome will not reflect the reality of the condition of the maintenance team. The fear is that individuals will manipulate their responses to their own benefit. Artisans will also manipulate the recording methodology to negatively influence the outcome. The assumption was made that the artisans will not understand the questions properly.

Artisans responded to the interviews and questionnaires with a high level of enthusiasm and this subconsciously also created expectations of positive changes for them. Some employees did not experience this, but they are pleased with the fact that an investigation is at least being conducted in their environment and that positive changes might derive from this process.

Conclusion

Comparing Pragma Africa assessment with the questionnaires develops an interesting dynamic to the analysis. There is a clear disconnect between what is expected in terms of maintenance standards and operations (Key performance areas) and the actual standards that the team is measured on (Key performance indicators). The company, as per the AMIP assessment, should move towards reliability centred maintenance with a preventative maintenance plan in place. The assessment clearly started poor availability for the machines remaining life-time and life-time covered.

This is due to insufficient maintenance processes and procedures, which will influence the lifespan of the machine. This perception is further exacerbated by the lack of recording of small breakdowns and the completion of the detainment schedule. Breakdown reports only display short descriptions of the incident, with no detail of the cause or possible preventative maintenance required in the future. The focus of the team is not a customer centric approach, but rather an internal focus process where availability is not the main objective.

The only agreement was that the artisans need a place and some motivators after retrenchments. It's clear from the interviews that the maintenance department needs a paradigm shift and it needs to start at managerial level. The function needs to strive towards world class recognition and to implement appropriate standards and processes to achieve same.

Norms to be introduced to measure the function on an on-going basis and to implement a preventative maintenance plan and system that ensure greater achievements and increase availability of the equipment and manufacturing plant. Creating a deeper understanding for CMMS and how this should be addressed. Implementing integrated systems and procedures to create a reporting line and system. The integrity of the system must be beyond doubt and must concentrate on detailed reporting of any incident, how same was fixed and what preventative steps can be taken to prevent a similar occurrence of this event.

Daily, weekly and monthly feedback sessions to be used to discuss the breakdown with the overall objective to introduce a preventative maintenance system to ensure higher availability and reliability. This process must be governed by clear systems and procedures, supported by monitoring full compliance and controls in place. A customer centric approach will be implemented and reinforced to improve the overall experience of any client.

Chapter 4: Strategic Planning and Process

The section will cover the strategy applied to change the strategic vision of the maintenance group. The overall strategy will complement the objectives of the maintenance group but will focus on improving the quality and cost benefit of this department. The leadership vision beliefs that if the quality can be improved and the cost can be reduced and correctly allocated, the unit will be able to achieve improved plant availability and reduce overall maintenance cost.

Chapter 3 performed a gap analysis to identify inadequacies in the existing strategy and this section will assist in addressing the weaknesses accordingly. This will start with a new vision and mission to achieve a paradigm shift in the overall maintenance function within this company. Focus will be on all levels of management and which processes and procedures can be implemented to achieve the objectives set for an improved maintenance department. Transparency and constant communications will be the important change drivers to ensure the team is informed and motivated for the needed change.

The strategy will also be focusing on cost saving measures by optimally utilising the existing resources, i.e. employees, infrastructures and plant & equipment available. The objectives will be tested by strategic models and theoretical weaknesses will be identified in the required plan and filtered towards the end. There will be a strong focus on theoretical applications like the strategic management process and models.

Introduction

Creating as strong leadership team with cohesion is required to lead this new strategy for the implementation period, including the training of the team to sustain the change. Creating a team cohesion requires a common goal and this will become the revised Mission of the Maintenance department. This will be supported by a strong vision on how the team will achieve success and continuous interaction will ensure group cohesion.

This team cohesion create a strong and driven culture towards a common goal, but it remains important for the individual to be aware that individual contributions will be required to improve the maintenance department within the maintenance values as agreed. Maintaining momentum of change and keeping individuals motivated will remain a challenge during this process and it is imperative that each person remains an integral part of the team with no casualties whilst in transit to a new improved position.

The strategic plan clearly identifies the objectives of creating the new mission. Maintenance excellence can be achieved by the service delivery, cost improvements, control and discipline, centralisation and restructuring, and operations support. The strategic management plan will show the plan and processes used to achieve the abovementioned objectives.

The developed strategic plan will be evaluated and improved as needed and also assist the change management and the expected outcome of the change. Embedded strengths will be embraced and weaknesses in the strategy will be amended. The SWOT analysis will clearly illustrate that the improvement of weaknesses can be expected within the new strategy.

Vision and Mission

The world and technology are changing on a daily basis. Companies will need to continue improving their current positions and plans for a sustainable future. Just as companies need to know the future, maintenance will need to stay on par with technology and processes to prepare for the future and become a cost effective department to keep the business within their markets competitive advantage.

Planning for the future the company will need a vision and mission statement that compliments and supports the objectives and the maintenance team will need to follow suit. The company aspires to be a cost effective competitive supplier but also needs to be one of the top quality brands available on the market.

The challenge is to align the agreed visions within a diverse team. The vision and culture with mutual respect and unity will establish the spirit of the team. (Connemara, Murray & Roberts, 2011, pp. 11, day 9) The four pillars to success starts with building a vision which is inspirational, but also take realistic boundaries into consideration.

Mission: Maintenance Excellence will be the mission of the group. The individuals will daily weigh their actions and decisions against the value of maintenance excellence, which is:-

- To render a superior service to customer;
- To provide world class quality solutions to customer problems;
- To improve the performance of the existing plant with preventative maintenance; and
- To provide knowledge and support and excel with improvement projects.

Vision: The vision captures the mission and how the group will optimally achieve this quality improvement by:-

- People: Inspire others with knowledge, empowering, teaching, enabling;
- Knowledge: Obtaining and distribution of knowledge from experience and history;
- Structure: Embraces transparency and accountability by the individual;
- Discipline: Adherence to procedures and policies; and
- Profitable: Recording cost spending and improving gains.

Maintenance Culture: Requires a paradigm shift to achieve the new mission and vision. The existing team's cohesion and culture require little change and the requirements for change will be more detailed, precise and informative to guide the team through the process of what needs to be achieved.

Maintenance Values: The vision will assist the group with sustaining maintenance excellence with individuals having to walk the talk and live the values daily to ensure commitment until the mission is achieved. The following values are to be practiced by all the individuals in the group:-

- Transparency: Communication needs to be clear, direct and in an understandable language and needs to reach all the participants swiftly;
- Accountability: The revised procedures will be monitored to improve accountability and to achieve the vision mission, utilising disciplinary actions if and when required; The approach will however remain soft to retain the goodwill of all the participants;
- Quality: Striving towards world class standards;
- Customer centric approach: Bringing the team and the customer closer; and

- Record keeping: Improve the quality by means of recording all maintenance incidents building a data bank for future preventative maintenance programs.

Strategic Plan

Professor Rosabeth Moss Kanter said that change management is “a culture that keeps moving all the time.” This statement emphasises the principle that change should be a continuous process. [23] A company or its employees who do not embrace this constant change will live in a culture of fear for change and they will stagnate or move into a comfort zone.

Professor Kanter further states that change is a constant requirement to improve and change management will facilitate such a process. It’s important to anticipate adverse reactions to proposed changes as this is a natural reaction from individuals. Companies can plan for this eventuality and prepare how to counter same to ensure that change is not a painful process, but an improved position to strive towards. Maintenance change cannot be enforced by discipline, processes, procedures and structures in isolation, but require individuals to accept and agree that change is required and participation to move towards this improved position. This requires a delicate balance between creating a spirit and team cohesion to embrace the change and what the company’s ultimate goal or future is.

When a quality cultural change is envisaged, it requires a paradigm shift from the current or existing standards and operations to a new set of standards and processes which will improve the function to a higher level of performance and to ensure the success of the maintenance operations. Individual’s natural reaction is to resist change and this will immediately create uncertainty and negativity which will affect the sentiments of a group. The challenge is to allay this fear and to continuously convince the team that change is needed and that this will result in an improved position, which will ultimately benefit all the employees. There needs to be regular communication and employees need to be assured on a constant basis, creating an environment where communication and interaction are not only a promise, but a reality.

This will be a long and tedious process which requires tenacity and integrity to ensure full participation. Employees want to trust the change management structure (individuals included), supported by constant communication. Relying on disciplinary action to enforce change will have an adverse effect as it will alienate individuals from the process. Creating a desire to change is a more adequate approach where individuals are encouraged to participate and use their expertise and knowledge to suggest improvements. The company must create a desire state in the future, which must be substantiated by experiences of improvements and personal achievement, i.e. promotion, incentives etc.

The quality output of the maintenance team can only be rated against world class standards or maintenance norms and systems to gain a true understanding of the quality of the maintenance function. It is therefore a priority what the standard and norms are what need to be achieved. This quality of maintenance would be on a preventative maintenance (step 8 of 13 of Hiatt’s list) standard and not to a complete RCM system but gaining a deeper understanding of the processes and what is required to operate as a world class

[23] Chapter 2, Strategic Management

maintenance group. (Hiatt, 2009). The currently CMMS system support only up to preventative maintenance level and requires improvement to support the drive towards world class standards.

Inculcating a sustainable culture, whilst changing the overall state of maintenance will be the real challenge – similar to repairing an airplane during the flight. Maintaining the momentum, motivating the individuals and retaining strong discipline after implementation require strong leadership from the management team. Constant interaction and celebrating successes will assist with the change program and culture needed. Managerial involvement and participation are strong driver forces for the team and the cohesion of the entire group – managers need to influence as the process develop.

Objectives:

As Steven Covey clearly professes: “Start with the end in mind...” (Covey). Objectives are what we envisage in accomplishing over this time of change. The objectives will encompass the mission of maintenance excellence and also embrace the vision for each individual in the maintenance structure. The strategy will be constructed with these objectives in mind and this will be implemented with strong support from executive management level. The following objectives will form the structure of the strategy and will be utilised as a tool in accomplishing maintenance excellence:-

- Service delivery
    - Inculcate a customer centric culture;
    - Improve skills and general knowledge;
    - SLA with internal customers to govern the relationship and expectations; and
    - SLA with supplier internal and external suppliers to ensure efficacy of deliveries and availability of tools and accessories.

- Cost Saving
    - Improve the preventative maintenance procedures;
    - Internal skill development plan, including apprentices’ development;
    - Waste management improvement plan; and
    - Revisit the current 3 Quote procedure.

- Control and Discipline
    - Training on processes and procedures;
    - Monitor the adherence to processes and procedures; and
    - Readdress the application of the internal discipline process to ensure fair application.

- Centralisation and Restructuring
    - Optimising the utilisation of skills and reduce lag times of employees;
    - Improve reliability and availability from plant and equipment; and
    - Reduce the overtime financial burden.

- Operational Support
    - Artisans to be authorised to operate can run machines; and

- Improve recording of data requirements with copious schedule attainment and breakdown reporting.

Strategy:

The overall strategy is to not re-invent the wheel, but rather to optimise the usage of the current systems and procedures. This department has not affected any changes during the past 5 years and requires new impetus since the retrenchment exercise in 2010. The maintenance strategy will stay in line with the previous strategy as the function remains a basic service to an internal customer, but the new approach to maintenance excellence will improve the overall customer experience. This will require improvements to the systems on order to meet the levels as set out in the objectives.

The title of maintenance team leaders will change to maintenance managers, which is more reflective of what is required from them. New artisans (6) will be appointed into the old team leaders position, which will be the only promotions recommended. The function of the maintenance managers does not change their core function or their responsibilities, but the focus will be more on the physical aspects of the maintenance function (preventative maintenance). Team Leaders will be more involved in proving a supporting function to the artisans during breakdowns.

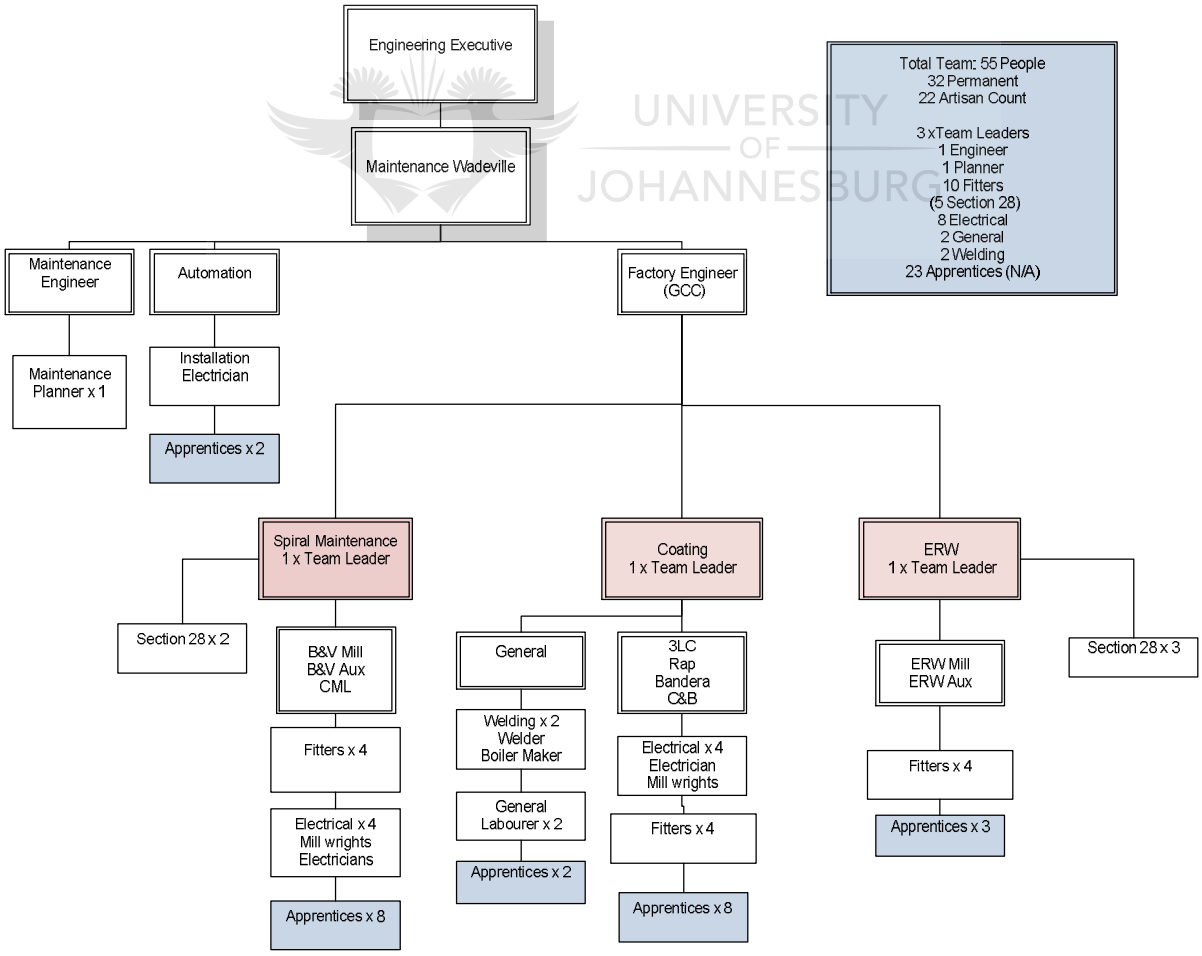


Figure 11: Old Maintenance Structure

Maintenance Managers will only get involved when availability affects manufacturing during crucial breakdowns and or large repairs. This will give maintenance managers more availability to improve strategies and apply proactive diagnostics to identify possible future problem areas or components. This analysis function of the schedule attainment report was previously done by the maintenance planner and CMMS. In order to improve this function and to achieve the objective of preventative maintenance, a closer working relationship needs to be develop between the functionality of the planner and the maintenance manager and to cross pollinate the knowledge and expertise required by both functions.

Maintenance Managers previously had limited time with Planner except report collection and occasional schedule changes and this will assist in the communication function. **Figure 11: Old Maintenance Structure** clearly indicates the old maintenance structure with Maintenance Team Leaders (New Maintenance Managers) and no support function to Team Leaders (New Section Team Leaders) or link to maintenance planner.

The new Structure will facilitate weekly meetings with Maintenance Managers and Team Leader for feedback discussions and breakdown cause analysis. The Team Leaders will have daily interaction with Planner when they file their daily schedules. This will be utilised to gain an understanding of the issues at hand and possible solutions, including outstanding issues / problems recorded on the CMMS system. Every interaction and note made generate a number on the system that will be discussed at the weekly, monthly and quarterly maintenance improvement meetings.

Maintenance managers are encouraged to communicate, follow, implement and embrace the new philosophy to the extent that same will become a lifestyle which will result in eventually reducing the managers working hours, including the possible stress and responsibilities, which are in the new structure, shared with Team Leaders. Managers will focus more on skills development and interaction with the bigger team. Additional available time can be used to focus on improving the plant and preventative maintenance resulting in a reduction in the downtime, which can yield better results for the company. Managers KPI will address the focus on cost reduction, availability improvement and machine efficiency to reduce the current downtime situation.

Maintenance team leaders will be new internal positions suggested for the 6 major subsections within the maintenance department. In **Figure 12: New Maintenance Structure** below, the Team Leader Positions can clearly be seen in Green. The appointments will emanate from the existing pool of competent artisans. The remuneration strategy will be to negotiate increase packages, however be exclusive of the overtime component which will incentivise them to improve the preventative maintenance efficacy.

The remuneration strategy must increase the fixed component whilst other cost, including overtime, must reduce (win win situation). The increase in the fixed component of their remuneration will provide comfort as it becomes permanent income which will also affect other contributions, i.e. pension. The quid pro quo for the company is increased responsibilities and improvement in efficiency – to be monitored by Key Performance Areas and Key Performance Indicators.

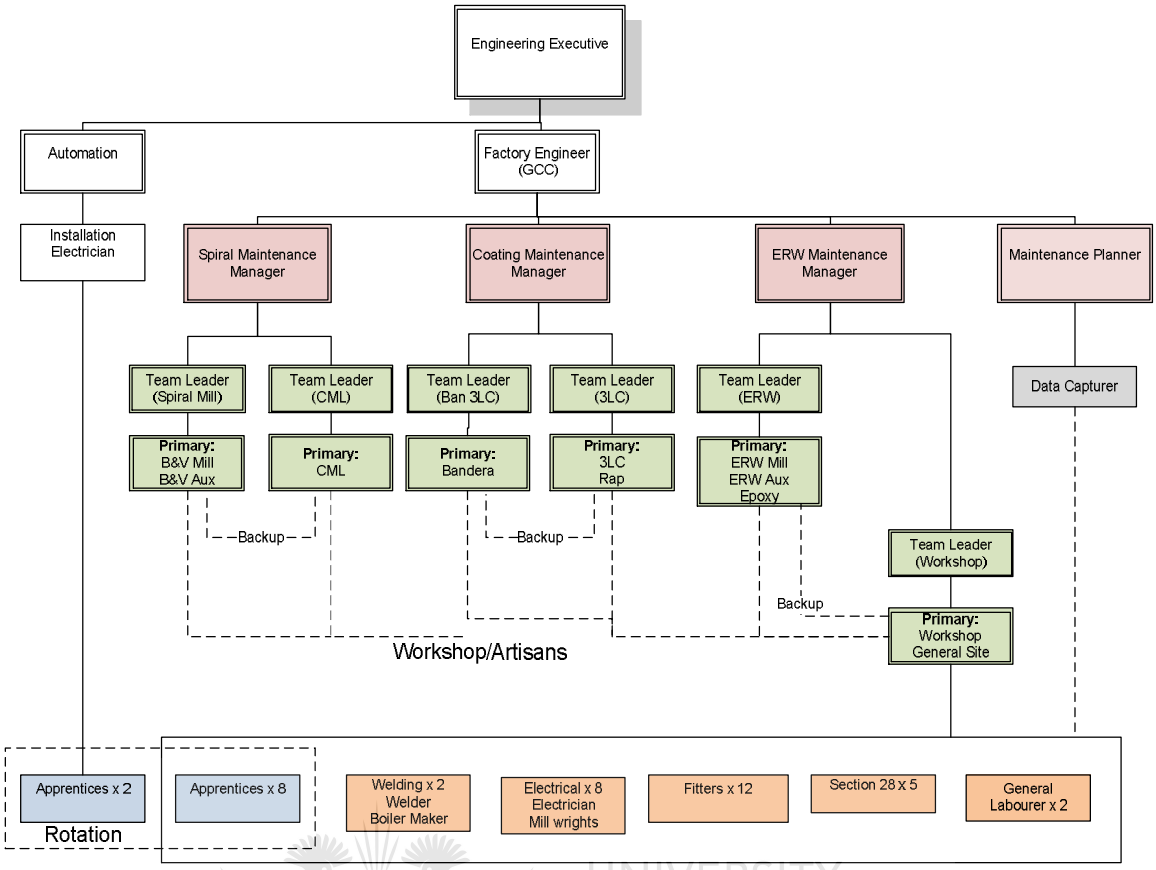


Figure 12: New Maintenance Structure

This structure in **Figure 12: New Maintenance Structure** compliment the centralisation strategy, with sufficient allowances being made to facilitate on-site support where needed. Resources are optimally utilised and additional work can be assigned if the team becomes more available over time when the benefits of preventative maintenance take effect. The maintenance engineer's roles will be replaced with a planner function, which will report to the Plant Manager. The major difference will be that the workshop Team Leader will ensure that artisans are placed correctly for easier assistance as per possible requests from other Team Leaders.

The planner will also ensure that artisans are rotated in terms of a pre-planned rotation system when weekly schedules are printed. In terms of the previous structure, apprentices will rotate between workshop and automation to increase the apprentices' knowledge and understanding of the type of automation used in the various plants. This will inculcate a learning environment and assist apprentices to increase their experience and exposure and knowledge of the manufacturing plant, which is considered an important step in developing world class artisans.

The benefit of up skilling these artisans to team leaders indicates to the maintenance group that the company value the individuals and want to retain long term relationships with the maintenance team. Their skills are valuable and they will operate autonomously to a certain extent in their respective sections. Empowering individuals normally creates new dynamics for the individual, which might have been previously neglected over an extended period of time.

Their interface with the production team will make them more sensitive for the needs of the production team and ultimately the client and this will establish a synergy bond between the parties. Production increases, and the availability of the equipment and plant should be included as a KPA and KPI's (matrix management) for both functions. This will ensure a shared vision on what needs to be accomplished. The Team Leader will also be trained to operate the individual machines and to perform quality checks to ensure an end-to-end process is applied when maintenance work is done.

The production schedules and distribution will be moved from the manager's workload to the Team Leaders, which will make the team leaders directly involved in inspections quality and using the rotation of employees. This will involve team leaders also in the effect of preventative maintenance and the importance of proactive maintenance response. Team Leaders will be responsible for communication in the plant. This will eradicate the previous disconnect between Production Team Leaders and Maintenance Team Leader.

The old structure in **Figure 11: Old Maintenance Structure** shows that there is just more Production Team Leaders (8) than Maintenance Team Leaders (3). This is why the new structure compliments the 8 Production Areas' with 8 Production Team Leaders and 5 Maintenance Team Leaders. Five was an appropriate as the mills and auxiliaries form a package and directly influences the other and the coating machine strictly sprays coating layers and doesn't manufacture primary product but only coating and it's considered as low a maintenance unit.

The top level Maintenance Managers and Plant Manager Structure will now be in line with the production structure with 1 Production Executive, 3 Production Managers and 8 Production Team Leaders – this will facilitate a friendlier communication structure. Managers will operate as a unit and provide support in this function if someone is not available or absent from duty, for whatever reason. This ensures that all information remains captured and informed decisions can be implemented at all times. An improved service delivery system can be implemented and maintained if the interface between parties improves. Team leaders should be more visible and active between the sites and workshops on an on-going basis.

The unsuccessful candidates for the team leader's positions will require special attention to ensure their commitment during the entire restructuring process. The team leader appointments will purely be done on ethics, experience, exposure and performance abilities and will be partly responsible to manage the unsuccessful candidates and to retain their goodwill for the good of the unit. The 6 individuals promoted will not be replaced and their function will be shared by the various functions and will then reduce the idle time in the artisans group. This improves efficiency and utilise current resources more optimally, contributing to the overall success of the unit.

The plant will operate on a 5 days a week basis with 9 hours production allocated for each day with 8 operating hours. The maintenance groups will be divided into two shifts which will cover morning inspections and the second group will cover the afternoon 3 hour maintenance shift. This ensures that there will be no overtime but 140% cover over production. Full cover when production is running at capacity and 10% for morning inspections and previous day checks and retesting, and 30% in afternoon sessions for general maintenance.

The artisans will decrease there working hours from 60 hours a week to a more manageable normal 45 hour weeks. This equates to exactly a 33% reduction in labour cost as costly overtime remuneration will be minimised. The two-shift system will cover the entire production cycle and ample time prior to and after product to affect preventative maintenance.

Centralisation ensures the pooling of skills and artisans can work together and facilitate the clustering teams of fitters, welders, electricians and millwrights, which will assist in the transfer of skills. The artisans will now be challenged and will be requested to work on plant and equipment in other parts of the production plant. This will assist with new skills being developed whilst being supervised by more experienced staff on that specific machine.

This experienced member will be a team leader as well as other artisans that operated in the specific area before. This hand holding process will continue until each member of the team is confident enough to operate alone, subject to the sign-off by the Planner and Workshop Team Leader. Team leaders will also cross pollinate skills and experience and assist where possible with vacancies that might exists at times and to retain the corporate memory of the specific machine.

Centralisation reduces the risk of losing specific knowledge in the group. The risk is reduced in a centralised unit - if an artisan or team leader exists from a decentralised position all the knowledge will be lost whilst with centralisation industry knowledge become more common knowledge. Centralisation spread the skills pool wider and can individuals be used optimally over a wider area. Overtime remuneration is important in the lives of the individuals in the unit and they became dependant on this additional income. Lifestyle adjustments needs to be taken to compensate for the loss of this income and this could influence the sentiments negatively in the unit.

This must however be a managed process and individuals must understand that the long term survival of the company is at stake and everyone will have to make sacrifices. Rotation between the areas, ratified by weekly inspections of each area will ensure that artisans will be more dedicated as the reporting will be verified on a weekly basis by a fellow artisan. This is also applicable to the early shift which will be responsible to declare the machines fit for use and production after it was signed off by the late shift the previous day.

Failed inspection week will be subject to a subsequent inspection until signed off and declared fit for use – this creates a cycle of verified reporting whereby failed inspections will always require a further check / test and signoff. Inspection / Schedules / Breakdown reporting will become an integrated part of each individual's performance, including quality reviews on a rotational basis. This will support a maintenance excellence drive to world class standards and norms, but on a measurable basis.

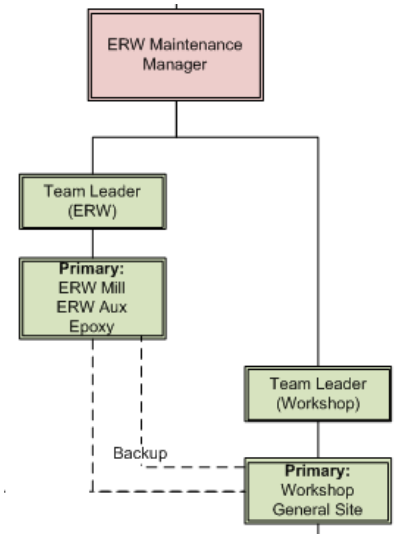


Figure 13: Artisan Line of Report

The Artisan reporting line was structured to permit artisan's to rotation and constantly learn new skills whilst delivering an output in the maintenance group. Artisan's direct line of reporting will be to the Workshop Team Leader that will be responsible for the distribution of certain skills tailored to address specific breakdowns and repairs. The planner will use the Workshop Team Leader as the point of entry to discuss his needs and to ensure the rotational philosophy remains efficient.

The Workshop Team Leader reports to the ERW Maintenance Manager due to the close proximity of this plant to the workshop and this will be the single line of support for discipline, training programs, performance evaluations, HR problems, IR problems, payroll problems, time sheet problems, etc.

Specialised skills training will intensify to cater for breakdowns on the specialised plant and equipment. This will reduce the lag time for repairs and costs if these functions can be performed in-house. Cylinder failure is a common occurrence due to the volume of cylinders being used. It is more cost effective to train an artisan and to equip him to do these repairs on site, compared to the current methodology of contracting this repair to an independent contractor. Doing the repair in-house will reduce the costs, reduce downtime and improve the skills and experience of an artisan. A cost benefit analysis will confirm same. This unit can become an internal profit centre.

The original proposal of a centralised workshop and bottom support centre was investigated and shows some benefits. But considering the restructuring and the chosen structure it makes more sense to use the bottom support centre for a chemical storage area and invest project money towards a maintenance service vehicle. This will be cheaper and a saving for the company. This will ensure the workshop has a dedicated forklift for internal use and a service vehicle to be used for bottom sites.

ERW section will always use a tooling expert and change over team. The centralisation might reduce the experience of artisans on specific equipment and machines during restructuring period, but assistance will be supplied by knowledgeable artisans and the tooling expert will in all probability be the new ERW and Auxiliaries Team Leader.

This process will be supervised by the team leader who will simultaneously make changes to the production function to ensure a total cover and experienced input to all tooling changeovers. Centralisation of artisans creates an opportunity for skills transfer and effective use of skills which was previously spread over the plant. The optimal utilisation of skilled individuals is now more effective. The possibilities increase when the engineering function will have easier access to practical skills, previously spread over the plant.

Quick fixes can now be discussed and engineers can be exposed to the problems artisans experience on a daily basis – this is a win-win situation where both parties gain experience from each other. This will reduce the cost as this can be dealt with in-house and combines practical machine experience and theoretical experience to solve problems to the best possible way. External suppliers can be contracted to support this function on a “in need” facility.

This will expose artisans to new levels of maintenance management and will assist in developing the individuals, which also act as a motivator. The Team Leader will be responsible for the labour distribution function and reporting, including the cost allocation per project and equipment repair / assist per location. This will be calculated on the time spent on plant and equipment and in which sections. This will become a measurable calculation and the production manager can now be held accountable with the maintenance manager. This might result in a reduction of waste costs and time spent.

The 3 quote system has always been an integral part of the company business, mainly due to the comfort it has provided over an extended period of time. Preferred suppliers became a routine and obtaining 3 quotes was a formality as suppliers provide each other with support when needed. The system was being abused by the parties involved to the detriment of the company.

Elevating this function to the team leaders to take control of the sourcing responsibility with guidance from the maintenance managers will have its benefits. The three quote system will be refined and a manager will always sign off any expenditure before any orders are placed. The constant involvement of managerial staff will force suppliers to be more proactive in sourcing cheaper alternatives whilst the internal customer will be more vigilant as the relationship will be governed by a SLA.

Operational support will be the responsibility of the Team Leaders. Team Leaders will need to have a deeper understanding of the functioning and operation of the equipment to be able to deliver in terms of the SLA. The team leader will ensure open communication lines between production and the maintenance staff, supported by a daily planning meeting with the relevant parties included in the SLA.

Strategic Process

The transformation has already gained momentum although the preliminary strategic plan is still being developed. The process of completing a draft strategic proposal and support same with some basic business ideas is in the making, and the interviews conducted resulted in bringing the parties together and ideas are currently been discussed around canteen tables and office gossip. The maintenance team is already testing some principles to test the viability of some of the information shared during the interviews. It appears that seeds were

planted during the interviews process[24] and some excitement was spontaneously. This confirmed the perception that the unit is ready for positive changes.

The mission, vision, culture and values are now in place, including the objectives of the strategic plan. The next section will cover how the process will be monitored, controlled and policed to ensure that the system is acceptable and will withstand the test of time. The employees are anticipating the restructuring and the expectations are that it will be to the benefit of all.

The strategy above is a roadmap on how to meet the objectives set. The focus of the strategy is to achieve the objectives by restructuring the personnel for optimum services and it reduces the ultimate loss of competent skills. Centralised workstations will ensure optimal utilisation of resources and a new structure to improve service delivery. Cost saving is integrated to the centralisation philosophy to improve the efficacy of the in-house workshop. This will be possible in the new model, but the process must be controlled and discipline is not negotiable. This is why the following processes (below) were developed to assist with the successful implementation of the strategy and successfully and therefore transforming the maintenance unit into a world class performer.

It important that a methodology to monitor all actions in the maintenance group is developed to ensure adherence to the principles employed. The new monitoring system will not yield results immediately, but will permit the users to improve constantly and to suggest changes to improve the cost benefit to the company. Negligent employees must face the consequences and unethical behaviour must be eradicated, even if the leader or supervisor needs resort to disciplinary actions.

Discipline is an important variable, which can influence the success of this strategy. It is therefore important to have a shared vision of what we want to achieve, how we want to achieve it and what is required of individual participants to make this a success. The glue for keeping the team as one unit is to ensure that no individual is lost in the process and individuals who lag behind must receive special attention to assist them in keeping up with the pace. A single line reporting system for artisans will assist with discipline in the unit and that all receive the same fair and equal treatment, irrespective of who is involved.

The following important processes and working guidelines were developed to assist the employees in the maintenance unit to understand the rationale for change.

1. CMMS System

2. Team Leader Daily Process
    a. Section Team Leaders
    b. Workshop Team Leader

3. Artisans Daily Process
    a. Morning Shift
    b. Afternoon Shift

[24] Chapter 3, Interviews

CMMS Process:

On Key is the current computer maintenance management system that's integrated with SAP for cost, inventory, etc. Essentially the interest would be focused on schedules or also known as inspections, statutory checks, preventative work schedules, etc. The Planner will mainly manage the CMMS system and the required inputs and output of the system. However, to ensure we have recordable history for the plant the following structure will be followed to ensure a 100% input with a 100% quality to have 100% accurate data.

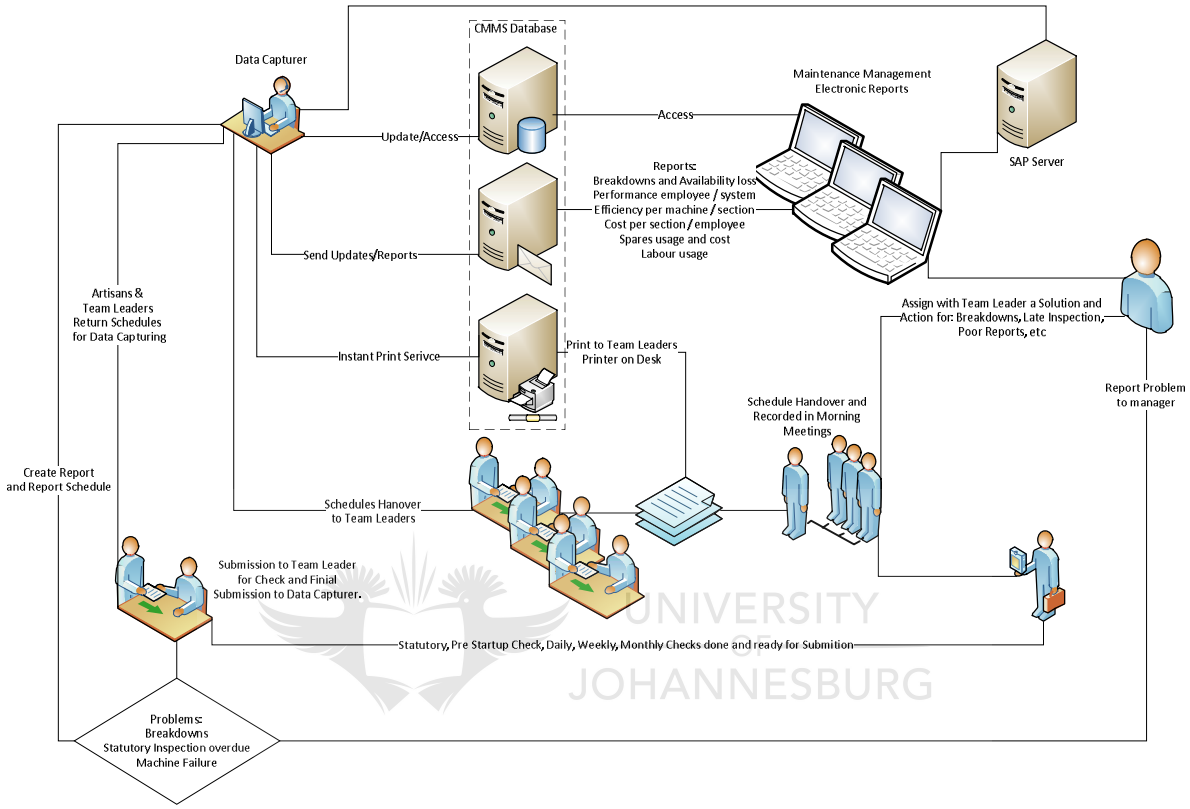


Figure 14: CMMS System (Appendix E)

Manufacturing schedules must be available essentially attaining 100% quality and return on time is very difficult but with proper process structure and control boundaries this will become easier as time progresses. Schedule will be issued on Friday mornings and given to Team Leaders at the weekly Planning meeting.

These schedules could go missing or miss printed and the team leader can use his check list to ensure all schedules are in place. If not it could be printed by the Planner or the Planner can print to printers close to the Team Leader. If all schedules are in place at Friday's planning meeting, the Team Leader can distribute them to his newly allocated team for the following week. The Team Leader will be with the artisans for only one working week and checking the schedules daily. Schedules are submitted to the planner for data capturing.

A backup process will come into play if the artisans discover that they are unable to fix a machine within the hours inside the production time. The Team Leader reports this to the Section Maintenance Manager, who will immediately get involved. Weekly reports are also sent to the managers which will be discussed with the individual Team Leaders or at the weekly meetings, depending on the urgency of the matter.

Team Leader(s) Daily Works Procedure

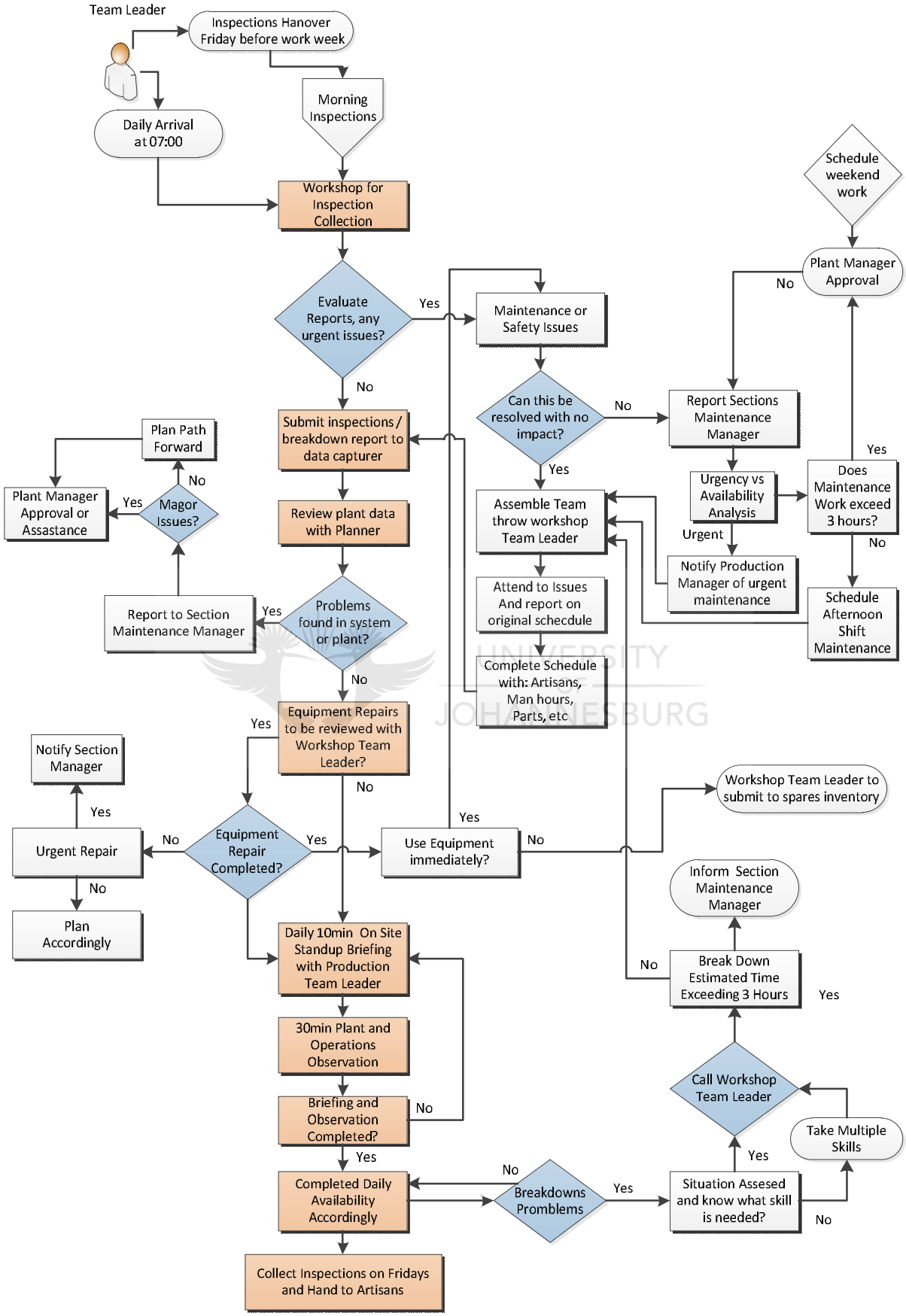


Figure 15: Team Leader Process

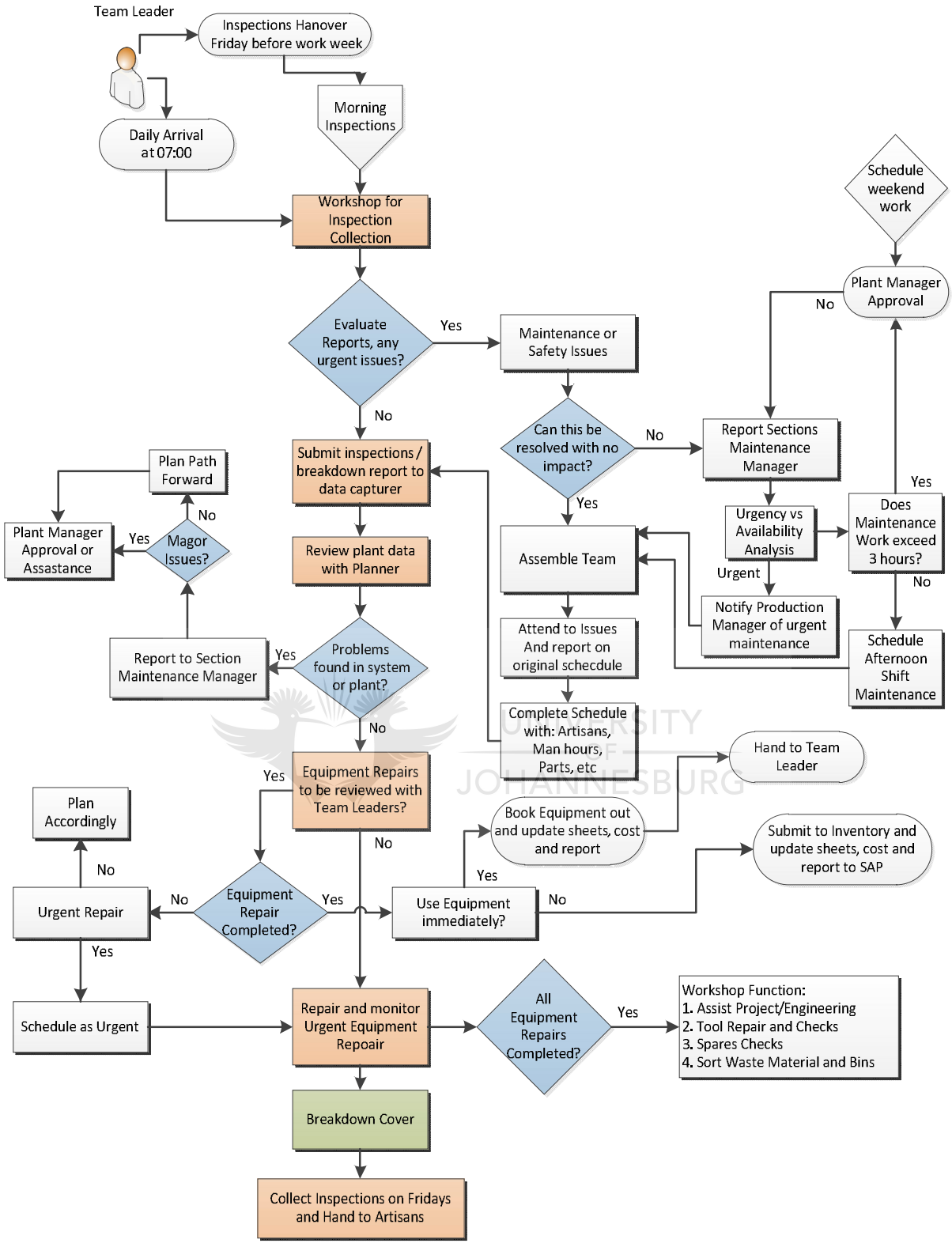


Figure 16: Workshop Team Leader Process

Figure 15: Team Leader Process and **Figure 16: Workshop Team Leader Process** illustrate the daily workflow process that the Section Team Leader and the Workshop Team Leader will follow to ensure high quality and thorough inspections, full time maintenance cover and interaction with on-site customers.

This also ensures that the group repair, maintenance, install and replace equipment efficiently without influencing availability. The Section Team Leader will receive plant information on arrival at the start of the production shift. This will be supplied by the morning shift artisans. The inspection reports of the day will be utilised to evaluate the status of the plant before switch on.

The plant information could also be utilised for monitoring specific situations or problems, i.e. bearing noises, hydraulic leaks, planned or un-scheduled maintenance and or shutdown maintenance. Repair decisions could be made immediately, scheduled for afternoon shift or if it is more challenging, referred to the plant manager for his input regarding delays it might cause, possible after hours repairs, etc. Inspections reports will then be handed to the planner and captured on the system.

Interaction with the Planner and Section Manager is of great importance to ensure the system is running smoothly and optimally according to strategy and amendments and changes can be made to improve the efficacy of the procedures. Constant interaction with workshop Team Leaders will be required to ensure repairs are done to everybody's satisfaction or to provide breakdown support. On-going on-site support will be embedded in the SLA negotiated between the Team Leaders and the production team.

This SLA will be specific and will be between that which governs the relationship between the maintenance Team Leader and production and not the entire maintenance group. The Team Leader will use the resources in a similar way to that of a contracting bases. Team Leaders will provide feedback to the maintenance Team Leader and the planning meeting regarding maintenance, plant and production issues experienced. The maintenance Team Leader will also be responsible for control over consumables and spares in his section and the workshop will be responsible for all equipment that was used were recorded on breakdown sheets.

The workshop Team Leader has no site interaction with the production Team Leaders. The relationship will be directly with the workshop artisans and the utilisation and development of their skills. The main focus of the workshop will be on maintenance to repair, sort and distribute. They will ensure that the working environment is safe and clean and provide instant accessibility. The workshop Team Leader will be responsible for the handling of general spares and the stockholding in conjunction with the store manager and SAP.

The section Team Leaders will be responsible to provide feedback on their requirements on the kind of spares, consumables and quantities needed at any given time. Spares and consumables used during a breakdown will be recorded by the store and workshop Team Leader in their records. This will also be recorded in the breakdown report to create a control measure for maintenance costs. Planned maintenance will be done on a similar basis, except that the spares, parts and consumables will be requested and supplied, as recorded on the maintenance schedule.

Artisans Daily Tasks

Artisans are divided into two shifts with diverse objectives. Morning shift will concentrate on machine pre-start inspections, small repairs if needed and perform an inspection of any maintenance done the previous day by the late shift. This will be an independent control function and a quality check.

The inspections will be handed to the Team Leader for evaluation and decision making. The artisan will then assist the section Team Leader, if needed or else report back to workshop Team Leader. The artisans will then follow daily workshop duties. **Figure 17: Morning Shift Process** flow clearly shows the roadmap for the artisan's daily schedule and the interaction with the section Team Leader and the workshop Team Leader. If the inspections indicate further difficulties, the workshop Team Leader will dispatch an artisan or a team of artisans to assist on site. The afternoon shift maintenance team will be responsible for ordering the parts, spares and tools for the morning shift, which should be ready for installation and usage when the shift starts the subsequent morning.

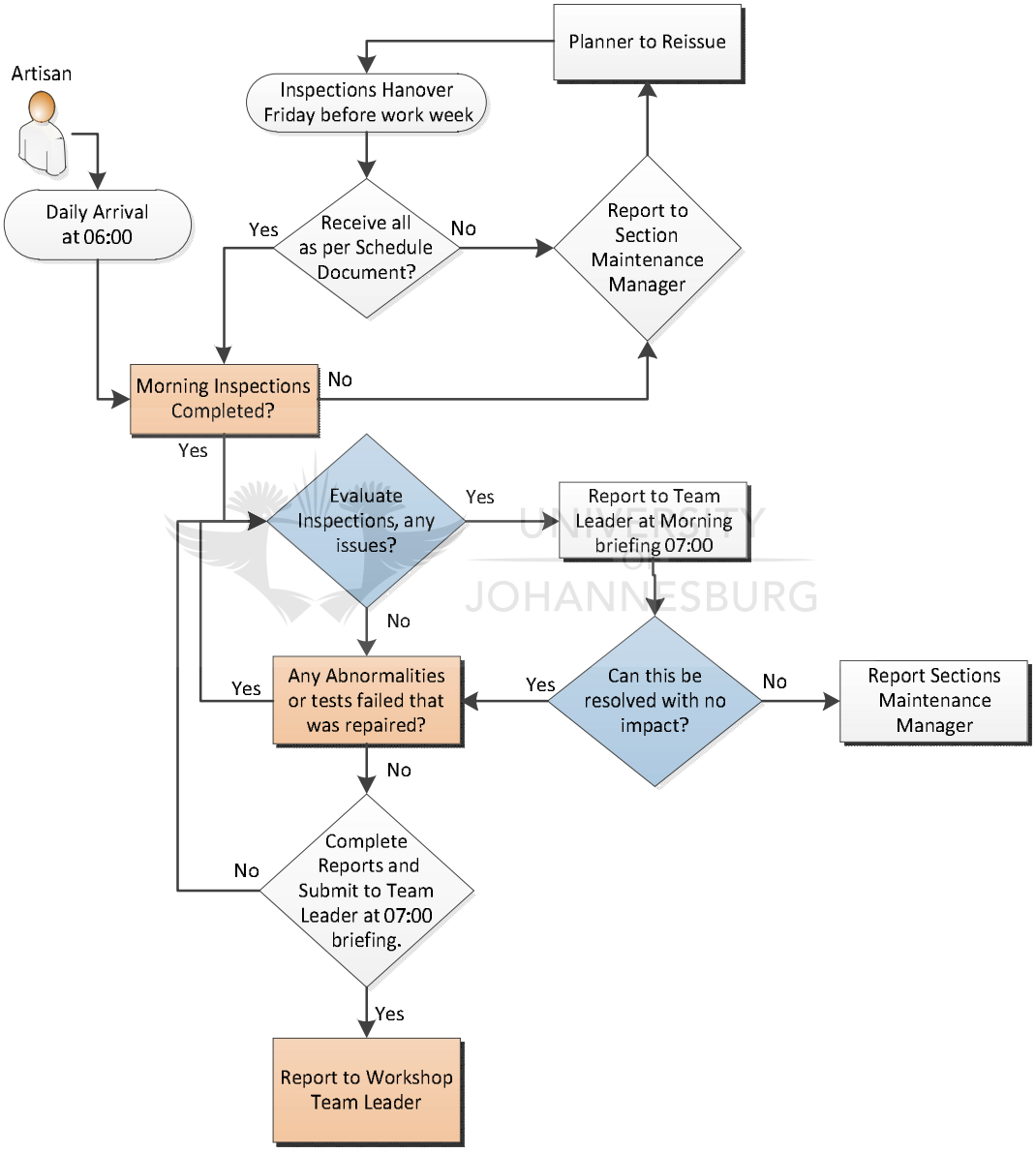


Figure 17: Morning Shift Process

The Team Leaders will plan maintenance work with the Section Maintenance Manager in need and the afternoon shift will be used to install or repair the necessary equipment. The afternoon shift will not have an inspection schedule for the week because this will be covered by morning shift. Afternoon shift will only repair and complete work and supply reports accordingly.

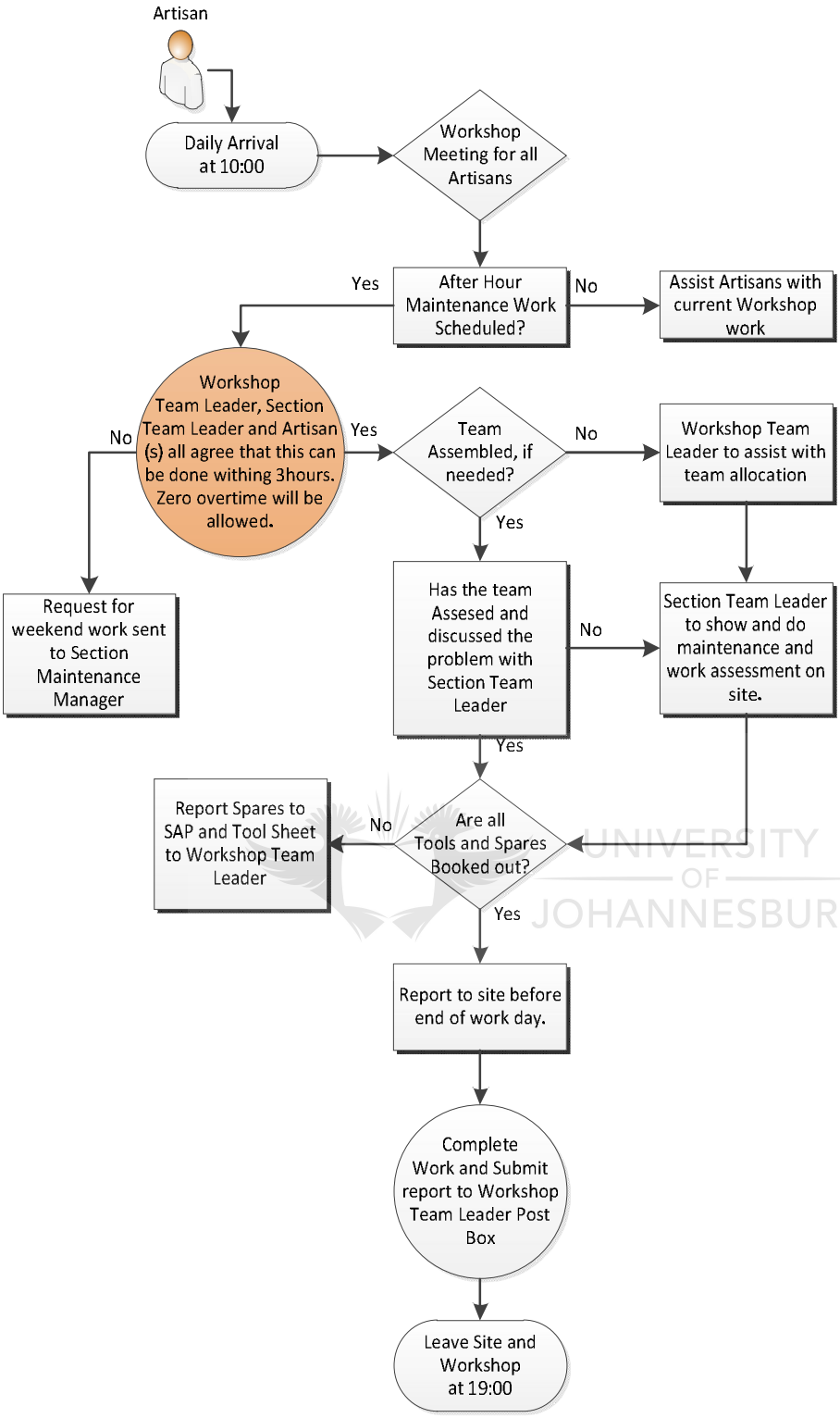


Figure 18: Afternoon Shift Process

It can clearly be seen that the roles in **Figure 17: Morning Shift Process** is totally opposite to the roles displayed in **Figure 18: Afternoon Shift Process**. Having the dual roles and double cover in afternoons creates a perfect time for training and team cohesion. The workshop Team Leader will use this to his advantage and develop and knit the team closer together. It is also useful to use this time to prepare for afternoon maintenance if needed, including equipment training and repairing.

End of the shift clean-up has always been an issue and the manufacturing operators will use the last 15 – 20 minutes of the shift to do site cleaning. It has been proposed that this can be done by the maintenance team, who will be operational during this specific time. A cost benefit analysis is required to assess this suggestion, although it will improve the efficiency of the operator. This could be a stumbling block for the artisan's team who will consider this a waste of valuable time. This will be investigated and evaluated after the structure is operational.

Evaluating the Strategy

The PEST (EL) analysis was integrated into the SWOT analysis, which covers the internal structure and the Political, Economic, Social and Technologies, (Environmental and Legal) effect, mainly on the larger business. It's clear that if the larger business fails this test, it will also result in a failure to a company. The analysis however focuses strictly on the Maintenance function. A maintenance team workshop was called and the following SWOT analysis results were identified and recorded.

STRENGHTS

- Skills are shared and developed ;
- Utilisation are optimised, recorded and evaluated;
- Individuals develop knowledge of all plants and equipment;
- Corporate knowledge is used in projects;
- Artisan and Team leaders have a clear single line of reporting;
- Team Leaders' knowledge and skills are optimised at the various sections;
- Team Leaders have a strong interface with the production team;
- Team Leaders are focused on preventative maintenance to provide onsite support;
- Workshop Team Leader's provide on-site development, training and repair maintenance skills;
- Workshop Team Leader controls skills distribution;
- Planner reports on skills development and usage and ensures weekly rotation for a spread of knowledge in groups of artisans;
- Weekly inspection rotation ensures artisans do not become too familiar, against the centralisation philosophy;
- Planner uses inspections and results for development and improvement;
- The Maintenance Manager's Workload is reduced;
- The Team Leader responsible for the section empowers the individual;
- Maintenance Managers can focus on preventative maintenance and skills development and usage;
- Resources are nurtured and retained;
- Centralisation reduces the cost and increases the workspace for storage for production;
- Vehicle for better service delivery;
- Team Leader on site and workshop interaction;
- Team Leaders evaluate forms and identify skills needed and can assist the planner in the rotation selection process as well as the workshop Team Leader for development;
- Compliment remains the same with a few promotions, which will inspire confidence;

STRENGHTS (Continue)

- Become customer centric without increasing the complement;
- Overtime is curtailed and requires managerial approval for authorisation;
- Proper information feedback processes and schedule hand over with accountability and further checks;
- Medium and low performers are identified with the assistance of schedules and training provided to support these individuals;
- Cost saving will filter through and remain on-going;
- Skills will always be available from the pool in the event of absenteeism;
- Rotational plan will provide a backup in the event of absenteeism;
- Rewards to high performers and innovative thinkers;
- Workshop establish an innovation facility, which will provide skills and development;
- Response time is reduced due to skills more readily available from a central pool;
- Improved transport system to reduce response time and to dispatch equipment, parts and or tools to the affected areas;
- Quality will improve as skills develop and improve on the various plant and equipment;
- Onsite plant training and “improvement workshop” to develop overall knowledge;
- Improved CMMS control and scheduling;
- Processes introduced will improve document control;
- Communication with the workshop will be upgraded and two way radio’s will be provided for team leaders;
- Improved culture experience with working together from the same premises;
- Reducing managerial supervision, but empowering the workshop Team Leader;
- Revitalised group with new mission and vision;
- Cost saving on overtime and increased in-house skills utilisation;
- Maintenance Planner becomes more interactive with Artisan level; and
- Team communication will improve dramatically once the team is centralised.

WEAKNESSES

- Individuals might be threaten by the additional controls in the system;
- Artisans may feel easily replaceable;
- Team Leaders plant exposure is now reduced to one or two sections;
- Workshop Team Leader my favour certain artisans and could create negativity;
- Planner absents may cause an interruption to the system and the effect needs to be fully investigated;
- The cost of centralisation will affect the short term position of the company;
- Artisans will be concerned about the loss of overtime payment;
- Performance based overtime and off-time;
- Time off as a quid pro quo for overtime pay might distract medium to low performers;
- Including a transport function into the systems will creates its own challenges;
- Multiple skills, experience and exposure on a single breakdown might cause friction initially;
- Team Leader can favour individuals;

WEAKNESSES (Continue)

- Tendency to revert to old true, trust and tried habits;
- The total dependency on Information Technology and the downtime due to possible system failures;
- Negligence of the maintenance managers' failure to implement and control the additional checks and procedures;
- Planner needs to improve his plant skills;
- Dependency on workshop Team Leader to identify skills and experience;
- Failure by the maintenance manager (Workshop) to monitor and enforce fair discipline;
- Delayed reporting due to delays caused by daily data capturing; and
- Reduction in trainees means fewer hands on the floor which could limit maintenance efficacy.

OPPORTUNITIES

- Be in a position to influence the production team;
- Greater cover scheme if production picks up to 6 days or 12 hour days;
- Improve the quality of statutory inspections and quality reports;
- Being involved in projects previous outside the scope of what is required from a certain function;
- Improve inter and intra relationships by being more visible and available;
- Substantial cost saving over the longer term; and
- Availability of experienced artisans to deal with breakdown over the entire plant.

THREATS

- The new strategy might not be approved and implemented;
- Production fails to support on site Team Leaders;
- Strategy needs to be aligned if the production cycle increases back to a 24 hour, 7 days a week cycle; and
- Loss of staff workshop and ERW manager.

This SWOT analysis will utilise the 20/80 principle and concentrate on the 20% which will make a substantial difference. The following Strengths/Opportunities and Weakness/Threats were identified as critical and supported or mitigated accordingly:-

STRENGHTS • Artisans are trained to company needs, service breakdown, repairs, preventative work and general knowledge. Knowledge and skills can be used for projects and improvements. • Team Leaders interact frequently with Customers and are focused on availability and prevention. • Maintenance Managers focuses on efficiency and availability. • Restructuring retains all skills. • Overtime reserved only for critical changes. • Control systems over schedules and capturing will improve. • Reduced response time.	**WEAKNESSES** • Artisan(s) may feel controlled by the new system. • Team Leaders are not properly developed in the new roles. • Workshop Team Leader may be biased against skills. • Planner/ Data Absents or not available. • Transportation risks. • Managers fail to implement, control and discipline. • Planner Maintenance requires additional training and knowledge.
OPPORTUNITIES • Change will inspire production team and strengthen relationships. • Maintenance cover is 9-18 hours of a day, 5 days a week with no overtime. • Develop Plant with Project Team.	**THREATS** • Strategy is not approved or implemented. • Production increase to 24/7. • Loss of key staff.

Table 33: SWOT Analysis

The focus will be to embrace the strengths and opportunities and to ensure that it remains the focus for the future. The weaknesses and threats will be considered and mitigated, but it's important to remember Lussiers' failure characteristics and identify how this can provide support. The customer needs and ability to interact is the backbone of the Team Leader's work philosophy. The commitment of employees must elevate to higher levels, but adherence to processes and procedures, including the monitor and control functions, must remain a focus for the section maintenance manager.

Any changes must be discussed and approved at all levels with proper communication to support the implementation thereof. Daily communication with all levels of customers is critical within the framework of the new strategy and processes. (Lussier, 2006)

The strategy requires executive approval and the cost benefit analysis will provide substantiation for the potential cost savings on the centralisation of the maintenance activities and the restructuring of the maintenance function to provide more cover and optimal skills usage. The strengths as per the SWOT analysis outweigh the weaknesses and or threats of this new model.

The production forecast for the next 24 months equates to maximum plant requirement of 12 hours, 6 days week availability. This can be adequately covered with new structure, cognisance should be taken that the "6^{TH} (weekend work) will attract overtime in the manufacturing environment. A key individual in the structure will be the workshop Team Leader and his support line will be the section maintenance manager. The reason why these roles are so important is because the two functions will control and manage the total skills in the maintenance group and risk of losing key individuals can cause disruption to the operations.

The Team Leader and managerial support will provide a backup function, if required. The planner will train maintenance managers to perform report printing and analysing same to cover the workshop Team Leaders' function whilst absent from duty. The planner will also have similar reports and will be assisted by the data capturer. A system report will fail it the data capturing is not up to date or when this function is not available – this will be mitigated by training an artisan to assist over short periods of time.

Maintenance managers previously managed smaller groups of artisans each with one manager, now managers will be able to manage a larger group more efficiently. Essentially the responsibilities are split between the manager and Team Leader. The Team Leader will ensure that the workshop responsibilities remain up to date with their workload and the manager monitors same accordingly. Managers will be evaluated via weekly reports and amendments will be made to ensure full and optimal efficiency of the manufacturing plant. This process will provide clear communication lines, which was lacking in the current dispensation.

Team Leaders' development will focus on the structure and onsite support. The risk of uncovered positions is mitigated by Team Leaders covering vacant sections during unscheduled absenteeism. The Team Leaders will therefore become specialist in handling the individual machines and products in the plant. Workshop Team Leader's will have the discretion on what skills to apply if specific skills are not available at that instance.

This function is also controlled by the artisan breakdown and repair reports and artisan utilisation will be shown on an hourly utilisation report. It will be abundantly clear which artisans are where and what function he is performing. The new system will be monitored by management and exceptions will be limited. This will support a work driven ethics philosophy with clear processes and procedures to guide them. The support and motivational function will remain important and care should be taken that no one is left behind in the process.

Conclusion

Creating and implementing a new maintenance strategy will result in ultimately a total paradigm shift for the individuals involved. The optimal solution is a fine balance between the needs of the company and the manufacturing function and what maintenance can offer and deliver with the current resources available to them or conversely how the resources will be applied to satisfy these needs. The analysis done in chapter 3 indicates a meeting of minds on most of the issues at hand with deviations in certain areas.

These deviations are not insurmountable issues and by changing role and responsibilities this can be dealt with to a large extent. The AMIP assessment previously conducted indicated a clear disconnect between the perceptions and realities of the maintenance

teams. The new strategy will address these issues to a large extent. The process indicated a lack of clear processes and procedures, which was the responsibility of the management team. This will now be rectified and world class norms will be used as measuring tools for future assessment purposes. This will embed a value for standards and expectations, which needs to be managed.

Centralisation is seen as a positive consequence and an improvement of the individuals' working conditions, i.e. from a small storeroom or factory space to a dedicated working area for the group – a portion which they can call their own. The workshop will have to improve their service deliver, which will be monitored by a SLA, which will govern the expectations and deliverables of all the parties.

Restructuring is not a luxury, but a necessity in order to bring new impetus into the unit, improving the customer centric experience and approach. The focus from Team Leaders on the customer centric approach will improve the customer experience. The refocusing on preventative maintenance will improve future availability and down time can become a scheduled event, resulting in overall cost saving and mostly overtime paid. The utilisation of in-house skills can ultimately yield very positive and lucrative results.

The weaknesses highlighted during the study will be mitigated in terms of the current resources and availability of skills. A controlled environment will yield its dividends over time as this mitigates the risk of negligence costing the company money. The rotational system will support the development of individuals and mitigate the risks of complacency. Performance ratings will be done on world class standards and via a uniformed basis, thereby eradicating favouritism or unfair treatment.

Chapter 5: Implementations Process

The strategic vision and mission are based on the strength of the strategic plan. Failure of this new strategy is normally attributed to a weak or incomplete implementation plan, including the inability to make changes as the implementation progresses. This chapter will prove the value of a steering team who will assist with the implementation and provide independent guidance on possible weaknesses and challenges which might be identified in the implementation progresses.

The steering team will be required to have a deeper understanding of the resources available, how to optimally utilise these resource and to harmonise all the participants in a smooth seamless process. The function will include the identification of possible challenges the company might face from a holistic perspective, i.e. public opinion or environmental impact. The change manager will be the driver and communicator of this implementation plan.

Introduction

The process in which the implementation team will introduce a roadmap for implementation, i.e. where to start with, who will be involved, who will oversee the function, frequency of feedback reports etc. The implementation schedule will be used as a strict guide for the steering team to oversee the implementation, step by step and to govern the process. This will include the decisions which will declare a step as implemented and ready to proceed to the following action / plan.

Approval will be required from the steering team to make changes or amendments from the original implementation plan approved by the Executive team. Quality control mechanisms will provide further support to the steering team as an independent information verification process. Related parties, represented on the steering team, will utilise this forum to comment / complain / compliment the changes already implemented and further judge the efficacy of the implemented changes.

Change management will explain the guidelines used for this implementation plan and how the change may impact on the moral of the individuals. No deviations from the plan will be entertained, unless approved by the steering team. Communication sessions will be held daily to keep all the parties involved and up to date with the progress achieved and small success will be celebrated when a step was successfully implemented.

Managers will walk the talk and constantly engage with the effected employees to ensure continuous commitment and to filter the impact of the changes they will experience. Selected committee members will interact with the affected individuals and provide emotional support whilst the processes are in motion. These individuals (motivators) will be given a short course in change management to equip them to deal with these employees and to ensure an all-inclusive implementation process where individuals will become active participants.

Figure 19: Implementation Plan - Level The under mentioned Gant Chart reflects the project plan governing the change processes. Executive approval will be needed before any implementation can proceed. This ensures that the executive level authorise the changes proposed in the management strategy and embrace and supports the implementation plan

and procedures. The maintenance managers and plant managers will be trained by change agents in managing the changes as well as implementing the changes.

Implementation Schedule

ID	Task Name	Duration	Start	Finish
0	**Implimentation Plan**	**105 days**	**07 Oct**	**28 Feb**
1	**Executive Decision**	**10 days**	**07 Oct**	**18 Oct**
3	**Manager Level Training**	**5 days**	**21 Oct**	**25 Oct**
7	**Site Clean-up**	**23 days**	**28 Oct**	**27 Nov**
8	Sort scrap yards	1 mon	28 Oct	22 Nov
9	Store Restoration Parts	1 mon	31 Oct	27 Nov
10	Waste Removal	1 mon	31 Oct	27 Nov
11	**New Appointments**	**2 days**	**28 Nov**	**29 Nov**
14	**Workshop Constrcution**	**25 days**	**28 Nov**	**01 Jan**
19	**Team Leader Training**	**20 days**	**02 Dec**	**27 Dec**
20	**Coating, ERW Auxiliries, ERW Mill**	**5 days**	**02 Dec**	**06 Dec**
24	**Bandera, 3LC, Rap**	**5 days**	**09 Dec**	**13 Dec**
28	**B&V Mill, B&V Auxiliries, CML**	**5 days**	**16 Dec**	**20 Dec**
32	**Workshop**	**5 days**	**23 Dec**	**27 Dec**
36	**Shift Changes**	**10 days**	**23 Dec**	**03 Jan**
40	**Workshop Commisioning**	**10 days**	**06 Jan**	**17 Jan**
41	Centralise group	1 wk	06 Jan	10 Jan
42	Training	1 wk	06 Jan	10 Jan
43	Move Tools	10 days	06 Jan	17 Jan
44	Move Equipment	10 days	06 Jan	17 Jan
45	**Schedule Review**	**30 days**	**20 Jan**	**28 Feb**

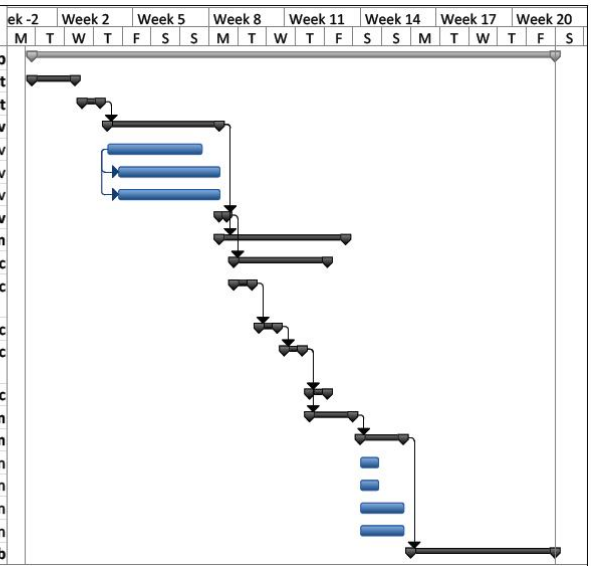


Figure 19: Implementation Plan - Level 2

The Plant Managers and the Executive Board will form part of the steering committee and the maintenance managers will implement the new strategy under the plant manager's guidance. The implementation plan is developed so that there are stages of implementation that is expectable before the major changes occur. The first phase will cover the site clean-up of old equipment and maintenance waste storage area clean-up.

ID	Task Name	Duration	Start	Finish
0	**Implimentation Plan**	**105 days**	**07 Oct**	**28 Feb**
1	**Executive Decision**	**10 days**	**07 Oct**	**18 Oct**
2	Approval	2 wks	07 Oct	18 Oct
3	**Manager Level Training**	**5 days**	**21 Oct**	**25 Oct**
4	Maintenance Managers	1 wk	21 Oct	25 Oct
5	Plant Manager	1 wk	21 Oct	25 Oct
6	Production Managers	1 wk	21 Oct	25 Oct
7	**Site Clean-up**	**23 days**	**28 Oct**	**27 Nov**
8	Sort scrap yards	1 mon	28 Oct	22 Nov
9	Store Restoration Parts	1 mon	31 Oct	27 Nov
10	Waste Removal	1 mon	31 Oct	27 Nov
11	**New Appointments**	**2 days**	**28 Nov**	**29 Nov**
12	Maintenance Managers	2 days	28 Nov	29 Nov
13	Maintenance Team Leaders	2 days	28 Nov	29 Nov
14	**Workshop Constrcution**	**25 days**	**28 Nov**	**01 Jan**
15	Paint	1 wk	28 Nov	04 Dec
16	Repair Offices	1 mon	28 Nov	25 Dec
17	Repair Worskop Structure	1 wk	28 Nov	04 Dec
18	Move Managers	1 wk	26 Dec	01 Jan
19	**Team Leader Training**	**20 days**	**02 Dec**	**27 Dec**
36	**Shift Changes**	**10 days**	**23 Dec**	**03 Jan**
40	**Workshop Commisioning**	**10 days**	**06 Jan**	**17 Jan**
45	**Schedule Review**	**30 days**	**20 Jan**	**28 Feb**

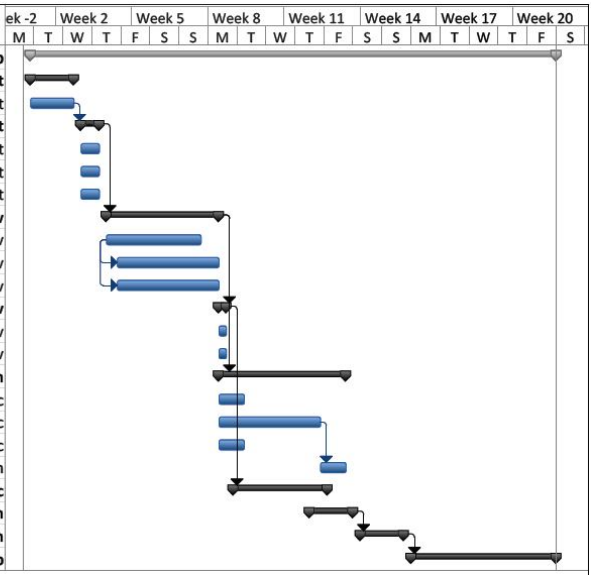


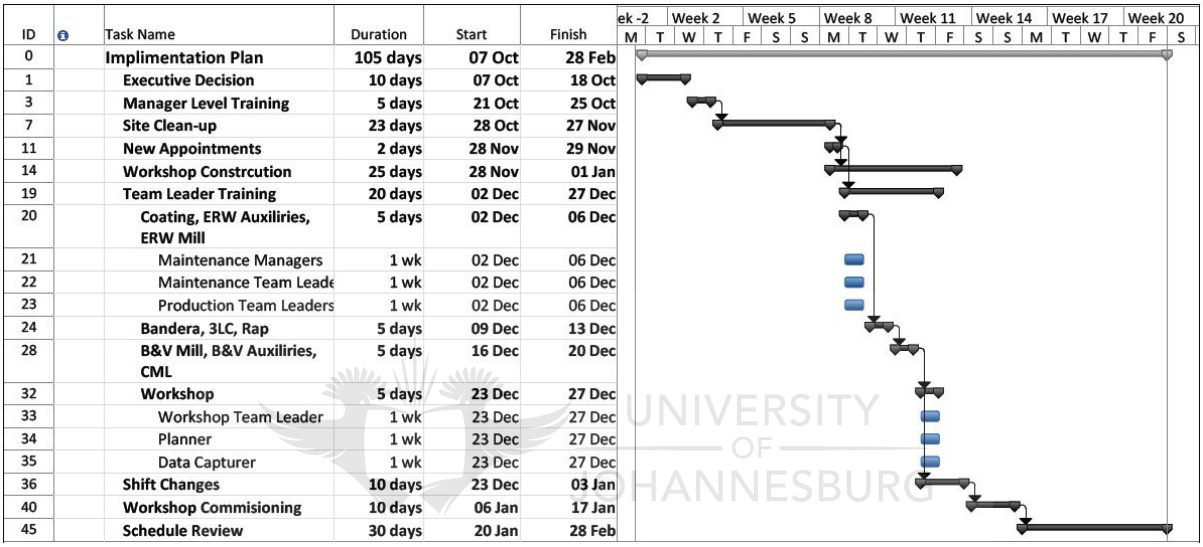
Figure 20: Implementation Plan 1st Phase

The old equipment storage area will be the new workshop. On completion of the site clean-up construction repairs will commence and this will be the appropriate time to appoint the new Team Leaders. These appointments will generate positive sentiments, which will be a great moral booster for the artisan team. Possible negative sentiments against the

promotions can be addressed at this stage and this will be ventilated during the next subsection of this chapter.

The 2nd phase will be restricted to training of the Team Leaders in 4 groups to ensure that production flow is not interrupted whilst the training is in progress. The groups will consist of production and maintenance Team Leaders to improve the team concept philosophy - this is one of the major attraction points for the individuals.

Team Leaders will engage in their revised function and new job description and will be eager to prove that the appointments were warranted. They will also be highly motivated and it is anticipated that these sentiments will spread amongst the rest of the team. The customer on shop management level will be involved in this training to understand the just of the needs and what will be captured as measurable in the SLA.



ID	Task Name	Duration	Start	Finish
0	Implimentation Plan	105 days	07 Oct	28 Feb
1	Executive Decision	10 days	07 Oct	18 Oct
3	Manager Level Training	5 days	21 Oct	25 Oct
7	Site Clean-up	23 days	28 Oct	27 Nov
11	New Appointments	2 days	28 Nov	29 Nov
14	Workshop Constrcution	25 days	28 Nov	01 Jan
19	Team Leader Training	20 days	02 Dec	27 Dec
20	Coating, ERW Auxiliries, ERW Mill	5 days	02 Dec	06 Dec
21	Maintenance Managers	1 wk	02 Dec	06 Dec
22	Maintenance Team Leade	1 wk	02 Dec	06 Dec
23	Production Team Leaders	1 wk	02 Dec	06 Dec
24	Bandera, 3LC, Rap	5 days	09 Dec	13 Dec
28	B&V Mill, B&V Auxiliries, CML	5 days	16 Dec	20 Dec
32	Workshop	5 days	23 Dec	27 Dec
33	Workshop Team Leader	1 wk	23 Dec	27 Dec
34	Planner	1 wk	23 Dec	27 Dec
35	Data Capturer	1 wk	23 Dec	27 Dec
36	Shift Changes	10 days	23 Dec	03 Jan
40	Workshop Commisioning	10 days	06 Jan	17 Jan
45	Schedule Review	30 days	20 Jan	28 Feb

Figure 21: Implementation Plan 2nd Phase

The training plan is illustrated above in **Figure 21: Implementation Plan 2nd Phase**. All New appointed Team Leaders will return to their roles and start the process with the artisans still decentralised. This will assist the Team Leaders in the changeover period and ensure that there is localised support at all times. The aim of this chance over a period would be not to interrupt production and to strengthen the customer's experience.

The workshop Team Leader and CMMS team will be trained at the end of phase one to ensure that they are ready for the phase 3 implementation when the artisans will start with the dual shifts and 2 weeks later the workshop roles.

Figure 22: Implementation Plan 3rd Phase This will reflect the bulk of the employees affected by the restructuring and changes. The introduction of the new shift system will become effective as soon as all the Team Leaders have been trained.

Shift changes will effectively spread the same volume of artisans over a longer period of time (13-18 hours) and this will cause pressure during the initiation phases and this will be monitored very closely. Overtime might be contemplated for the first week to facilitate the phase over. The workshop will also require assistance during the corresponding period whist the new systems are being introduced.

ID	Task Name	Duration	Start	Finish
0	**Implimentation Plan**	**105 days**	**07 Oct**	**28 Feb**
1	**Executive Decision**	**10 days**	**07 Oct**	**18 Oct**
3	**Manager Level Training**	**5 days**	**21 Oct**	**25 Oct**
7	**Site Clean-up**	**23 days**	**28 Oct**	**27 Nov**
11	**New Appointments**	**2 days**	**28 Nov**	**29 Nov**
14	**Workshop Constrcution**	**25 days**	**28 Nov**	**01 Jan**
19	**Team Leader Training**	**20 days**	**02 Dec**	**27 Dec**
36	**Shift Changes**	**10 days**	**23 Dec**	**03 Jan**
37	Decentralised Artisans	2 wks	23 Dec	03 Jan
38	Change shift	10 days	23 Dec	03 Jan
39	Team Leader On Site	10 days	23 Dec	03 Jan
40	**Workshop Commisioning**	**10 days**	**06 Jan**	**17 Jan**
41	Centralise group	1 wk	06 Jan	10 Jan
42	Training	1 wk	06 Jan	10 Jan
43	Move Tools	10 days	06 Jan	17 Jan
44	Move Equipment	10 days	06 Jan	17 Jan
45	**Schedule Review**	**30 days**	**20 Jan**	**28 Feb**
46	ERW & Coating Team Leader (Tooling Spesialist)	1 wk	20 Jan	24 Jan
47	Bandera Team Leader	5 days	27 Jan	31 Jan
48	3LC & Rap Team Leader	5 days	03 Feb	07 Feb
49	B&V Team Leader	5 days	10 Feb	14 Feb
50	CML Team Leader	5 days	17 Feb	21 Feb
51	Workshop Team Leader	5 days	24 Feb	28 Feb

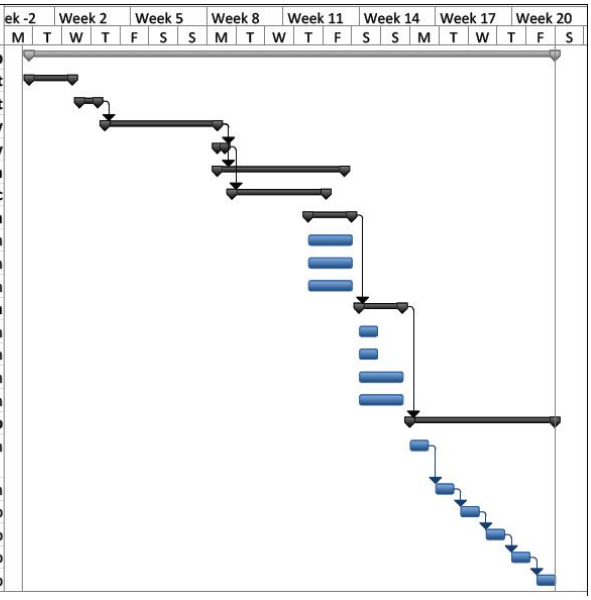


Figure 22: Implementation Plan 3rd Phase

The training provided will concentrate on skills required during the phase over period. Training will not be limited to technical requirements, but include basic interpersonal skills training, conflict handling and human resource functions. Once the improvements are implemented at the workshop the team, will be allowed to move to their future centralised working area. This will permit for debriefing discussions after the shift change. The creation of a workshop and team rest facility will definitely be considered as major attraction, as this will facilitate the opportunity to be seen as a single team with their own facilities.

The Team Leaders will at this stage receive their training and management would have had the opportunity to spend some time with them and build relationships which will act as a motivator and create some energy in the system. The workshop manager and supporting maintenance manager act as motivators to constantly create energy in the group and to provide support, making sure that no individual lag behind.

Deviation will be discouraged and the other maintenance managers will assist to monitor the execution of the plan and to ensure full adherence. Schedule reviews will be done with new Team Leaders to improve the quality of output and initiate the preventative maintenance plan on the CMMS, keeping contact with the manufacturing plant and planner.

Change Control

Management will be trained to oversee the restructuring process as well as to assist with the change management processes. The trainer will emphasise the need for collaborative engagement and providing support, embracing the change philosophy whilst holding a strong hand (iron fist in a velvet glove). The training manager will ensure that all the managers have a deeper understanding of the requirements of the implementation plan and open, honest and transparency are all key elements to the successful implementation of this plan.

To ensure that change is managed, the following process will be contracted with all. The processes illustrated in **Figure 23: Change Process** will occur parallel from the start (Top) to end (Bottom) using the basic phases of the plan to the change theorems on the right and

internal change actions to the left. The green coloured internal changes explain the timelines for the workshop changes and implementation. This is followed by motivational and debriefing discussions (Blue) being used to support the change. The implementation plan follows towards the centre with motivational areas in yellow. These motivational areas are identified as the critical change and motivation stadia. The right side theorems were formed form Prosci's and Kotter's theorem on the outer right.

As mentioned in the implementation plan the change process will need a strategic change plan and this is illustrated by the implementation plan. The implementation plan is displayed in a process format in the centre of **Figure 23: Change Process**. The two critical motivation periods will be when the new Team Leaders are appointed because there might be some de-motivation and when the employees are working double shift on a zero overtime policy.

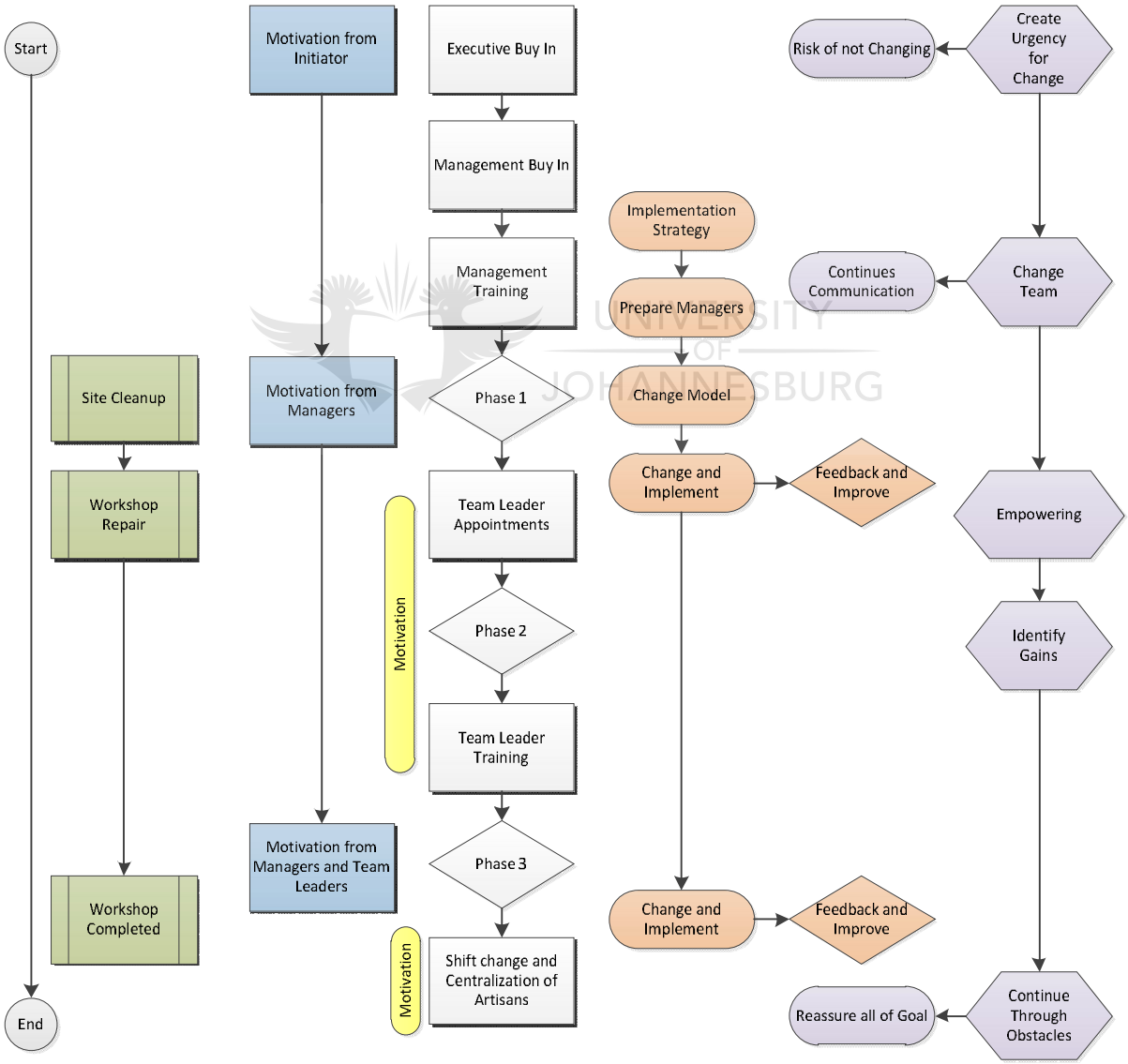


Figure 23: Change Process

The newly appointed Team Leaders will be taken of the system and function to equip them with improved interpersonal skills, client interphase, human resources, including HR policies and procedures training. The focus will be on be operating independently putting the customer first to keep the team energised and motivated, before the start of the 3rd phase.

Prosci's process supports Prof. Kanter's change management theory of cultures keeps moving all the time and Prosci encourages change and implementation with constant feedback and improvement. To ensure the new maintenance excellence culture continue to grow the group needs to take cognisance of the approach change that it is not a single action, but a sustainable action that are continuously challenged. It is important that each member of the various teams embrace all the objectives, whilst understanding the impact on the human elements and behaviour during a change management process.(Jones, 2004)

Managers will constantly evaluate the process and make amendments or improvements the process or implementation plan. Surprises are part of the cause part when changes are experienced in a working or social grouping and these surprises must be expected and addressed immediately when it happen – confrontation must be escalated one level up to maintain the interactive and collaborative approach. Nobody must lose sight of the objectives and side tracts and deviation must be discouraged and monitored.

Anticipated Constraints and Risks

- Deviations from the Implementation Plan which could affect the end results;
- Artisan change management at two critical areas;
- Team Leaders new roles might undermine their confidence for a while;
- Maintenance Manager will have a major change management responsibility over and above their daily functions.

The above will be mitigated during the implementation plan and the implementation team will monitor for any abnormalities experienced in the process and report same on a one up level or to the steering team.

Motivation

James Day Hodgson, former U.S Ambassadors to Japan described culture of an institution as the sum of values, rituals, symbols, beliefs and thought processes which are shared and inherited through interaction with each other over a period of time (Cateora, 2008, pp. 100-101). It requires a vast amount of effort to inculcate this culture change and requires a detailed change management strategy to embrace the new environment. This process will utilise the change management process to guarantee sustainability.

The strategy covered the support and inspiration used on various levels of the structure. The energy and motivation created was a direct result of the meeting of minds with the need for change expressed by all the participants, which was discussed in chapter 3. The benefits of the new order will outweigh the negatives of the previous order. The reduction in overtime will affect everybody and some individuals will experience discomfort with the introduction of the morning and afternoon shifts. The new conditions will create new opportunities for some (promotion) and common recreation rooms and dedicated working areas will provide a counter balance and nobody must lose sight of the benefits to the company and eventually all involved. Management must walk the talk and realise that motivation cannot just be on the floor but has to filter from the management down. (Mol, Motivation)

Strong motivators will be individuals with the influence to have an impact on others, especially in the artisans' function. The Team Leader is tasked to motivate and energise the group, provide guidance and support and ensure that nobody is left behind. The motivational tree of the artisan level is important to understand and that certain artisans will be at different levels. Maslow's hierarchy of motivation is illustrated by the tree, which is developed specifically for the team and level of implementation. The first and basic motivator will be that the employees are still employed and they are stable for the future. This would cover the first level, and dips into the second level because certain salaries will be influenced. This must however not be used to distract from the common end goal.

Negative financial experiences will affect more than just the individual's working conditions, it will also affect his financial standing in his family as less cash flow will be available to spend and everyone in the family will experience the impact of this. This can lead to tension at home, which might affect the individual's ability to apply his mind and full concentration. The company will provide financial consultants to assist and counselling when required.

The elevated Team Leaders will assume their new functions and responsibilities and relocate to the designated area with their respective teams and management channels will be open and more accessible than usual. The new structure compliments Alderfer's ERG theory where all employees will fit into a structure with existence and this existence will form the maintenance excellence culture. The rotation and shift will affect everyone and as soon as the benefits filter through everybody will experience it. Participants will embrace same as it will provide more stability in their working conditions with an increased ability to plan on a longer terms basis as overtime will not intrude on their time with their family.

Steering Team

The steering team will consist of the executive team and the plant manager, who will be responsible for an independent view, providing guidance and support and approve or authorise small enhancements to the implementation plan and strategy. Unexpected deviations and amendments can be tabled at this forum for noting or authorising purposes. The steering team will provide constant feedback to the entire team with open lines of communications and accessibility.

Executive Steering Team:

The Exco steerco will monitor the progress from a holistic perspective focussing on public opinion, customer's experience, improvement in production output, cost savings and cost reduction and evaluate any increase for additional funding, including the overtime costs. The benefit derived from the quick fixes, i.e. cash for scrap, overtime reduction, contractor appointments will be tracked and used as a yardstick to determine the success. The longer term success will also be monitored, i.e. increase in production, reduction in downtime and the overall length of the down time and associated losses sustained within the plant. It is important for the team to understand that the success will be monitored and judged at the highest level, which could leave them vulnerable or very energised if the implementation is celebrated as a success.

Plant Manager:

The plant manager will be the implementation representative in the Exco steerco and also full fill the function as the implementation Team Leader. The plant manager will monitor the requirements as set by the Exco Steerco and provide continuous feedback on the progress.

Implementation Team:
The implementation team consists of the maintenance managers and the plant manager which focuses on the implementation plan as illustrated in **Figure 19: Implementation Plan - Level 2**. Their objectives are clearly annotated in the strategic plan and change management will drive the process until full implementation is completed.

Conclusion

Implementing a new strategy requires skilful planning and projections, supported by a clear vision, mission and implementation plan to achieve the ultimate goals. These changes should be monitored, supported and managed to methodically implement all the steps in the implementation plan, but simultaneously provide support for the effected individuals in the process. Open communication channels with constant feedback sessions to all participants' remains a critical ingredient in keeping people involved and motivated for positive change experiences.

The purpose of the strategy was to implement improved maintenance methodologies which will be to the benefit of the company, but also have a positive spin off for the individuals in the structure, thereby improving the inter and intra experiences of the customers. Change management will provide training and guidelines to facilitate a smooth change over, whilst all the critical function still perform at 100% - fixing the airplane during the flight. The implementation plan is a step-by-step roadmap to achieve the set objective within the given time parameters and limited resources. Clear guidelines and procedures will provide a form of reconfirmation of the individual's perception of what needs to be achieved and accomplish.

Critical areas of possible stress and de-motivation were identified and pause periods were included in the implementation plan to facilitate time to re-energise and re-motivate the participants. The implementation will draw to a close with inception of the new workshop and training area.

Chapter 6: Sustainability of the changes

This chapter will deal with the sustainability of the change management processes, procedures, people and assets with the utilisation of a CMMS system, which provide the golden thread for recording and measurements. Sustainability will be more evident as and when certain sections of the implementation plan become effective and embedded in the new structure. The strategy employed in the new dispensation will support the company's current view of containing costs whilst not in an optimal production cycle, but will leave sufficient scope to include variables to cater for a full production cycle.

The promotions suggested will not increase the company or the maintenance complement, but will increase the efficacy of the system of providing skills where needed. The promotions might increase the remuneration budget, but this will be off-set by the substantial savings achieved in overtime costs incurred over the past year – overtime is paid at 1.5 times the normal hourly rate and on Sundays at 2 times the normal salary rate. The cost benefit analysis of the overtime savings over the next three months will fund all the changes over the entire introduction of the new and improved procedures. The underlying benefits of more skilled employees, preventative maintenance procedures and improved employee wellbeing were not even discounted in this cost benefit decision.

Sustainability of Employees

Companies need employees with skills and experience related to their assets. Training new employees will increase the cost as well as the time to bring that skill to the standard of the pervious employee. There is also a risk involved that the replacement skill is of a lower quality or the individual is not comfortable with the company culture and leave as well. Stability of skilled employees is of high value and these employees should always feel valued and needed. Higher skill levels will normally look for stimulation and if this can be provided the skill will perform and stay motivated.

Manufacturing companies are dependent on plant and machinery to produce the product which will create a sustainable income stream for the company and a dividend for the investors. The company is as equally dependent on skilled employees to maintain the equipment to provide to permit continuous availability of the equipment to produce on an uninterrupted basis. Disruption or breakdown must be curtailed not to influence production and normal maintenance and precautionary maintenance can be done outside the hours of productions to facilitate this.

The company's dependency on skilled labour requires a strategic plan to provide for a long term relationship with the existing employees, but also creates a desirable environment where others want to work. The company will introduce a process where skills are retained or the loss of skilled workers will be mitigated. The proposed training plan will endeavour to train all employees to a minimum level required for their respective functions, but simultaneously provide a wider skills base to mitigate unforeseen losses and or loses of skills. The investment in training will also provide a sense of comfort to the employees who will view this as an investment in their future, whilst improving the individual's skills level.

The training program was developed to provide an overview of the entire production process and critical or focus points in the maintenance of the plant and equipment. The first phase will focus on practical artisan skills which will place the emphasis on working harder do not equate to working smarter.

The second phase will focus on interpersonal skills and leadership qualities and how to improve same. This will provide a measure of flexibility to assist the company with trained, skilled and experienced artisans already in the system and a good training ground when existing employees leave and replaced by lesser experienced staff. This will also provide the artisans with career opportunities with the introduction of the Team Leader function.

The training will revitalise the dedicated and motivated individuals to grab the opportunity to improve them and to become more marketable in a very competitive environment. Skills and experience equate to value for an employer and growth potential for the individual will improve the position for both. This will improve brand awareness and company loyalty as contented employees are a lot easier to retain. The above mentioned are illustrated and explained in diagram in **Figure 24: Internal Training Program.**

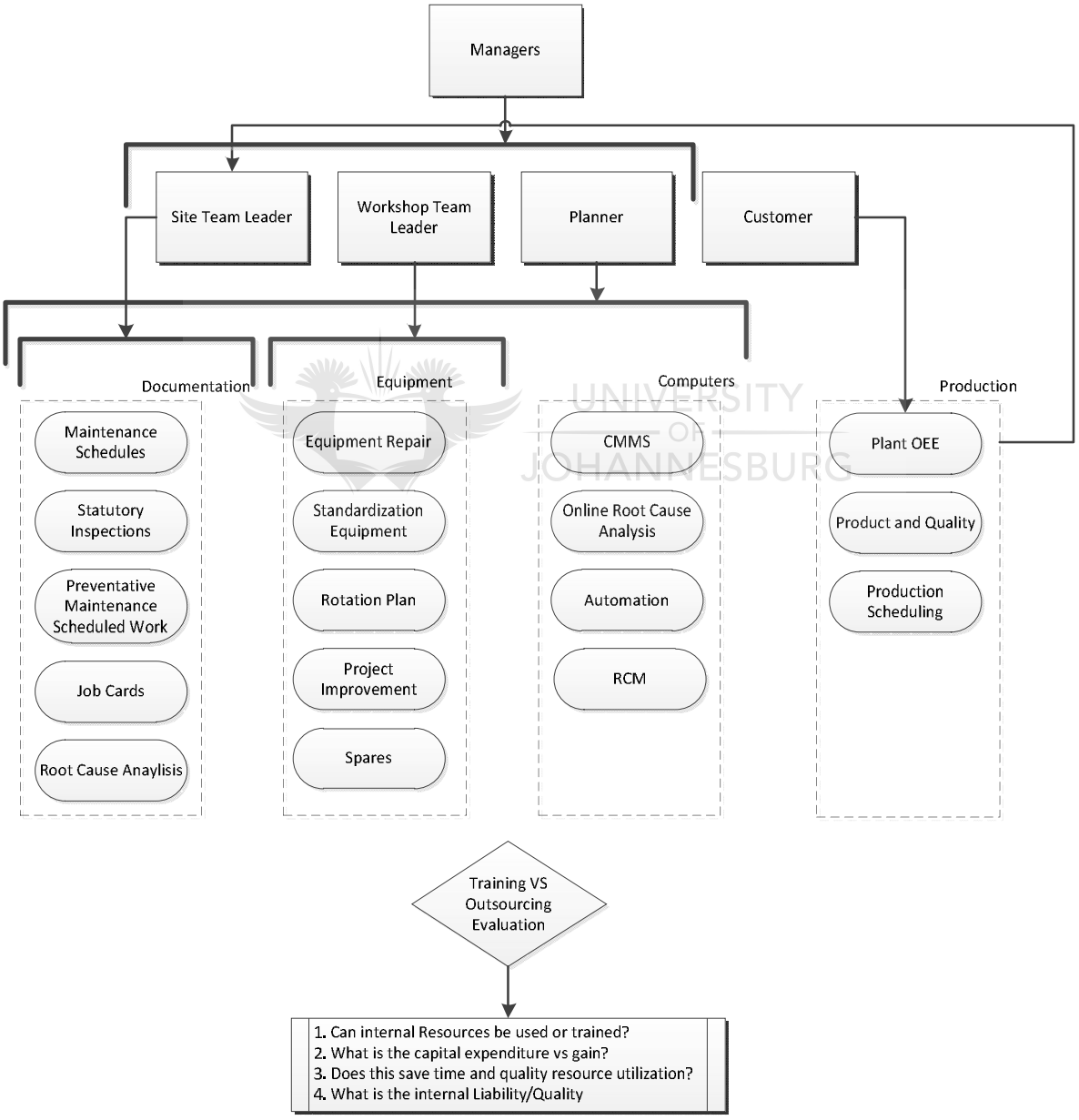


Figure 24: Internal Training Program

On-going training for the artisans on site will be done by a Site Team Leader, with emphasis on plant and equipment knowledge and schedules. The workshop Team Leader will focus on developing artisan's skills and knowledge and use their knowledge to improve the maintenance quality. The planner will continuously interact with Team Leaders and various mangers to carefully monitor and assist with improvements made and the rotation system introduced. The planner will also provide training to the artisan's pool on the CMMS system and the value it could deliver and to embed the utilisation of these records and schedules in the future.

The rotational system will be considered as on the job training and part of the improvement of individuals, with emphasis on the artisans and apprentices work procedures in the future. The weekly and monthly rotations meetings will be on a scheduled basis and will also be used to monitor the progress with each individual. The first scheduled rotation will be undertaken with the weekly inspections per individual plant, which will include discussions on the week's service delivery and availability of artisans. The monthly rotational meeting will include the apprentices and will be utilised to discuss the month's production, the following month's production schedules, the availability of plant and equipment for production, the down time experienced and how these factors influenced the production output and ultimately the customer experience.

Training by the internal customer will especially be used on the Team Leader level to ensure that there is proper collaboration between the two departments. This will provide a possible future career for the Team Leaders as the production unit can also draw on the expertise which is now being created in the maintenance pool. Their experience and exposure in the new function will provide them with adequate training to progress into the production area. This possible new career from maintenance to production will not only affect the artisans, but the company will retain valuable skills and experience already paid for. The training of Team Leaders to operate the plant and equipment will provide a further comfort to the company as critical skills will be available in the event of unforeseen circumstances in the production environment.

Managers do the holistic training on the importance of schedule compliance and reporting and CMMS reports. Team Leaders must embrace the CMMS reports as an important tool in their arsenal to manage the monitoring on compliance. Reports need to be detailed, factual and timeous to provide real value. A report will be required for every small incident to build a database on each machine in the factory, to determine the real cost of maintenance per piece of equipment or machinery. The importance of detailed and timeous reporting with clear identification of the resources used should not be underestimated and this will be clearly identified in the power off report. Managers will also use this meeting to explain the impact of the preventative maintenance advantages and approach and how this will be facilitated during the weekly planning meeting.

The training program will also include the internal client as illustrated by the communications plan in Figure 25: Internal Communication Plan where a bottom up approach will be used. The bottom up communication mechanism will provide management with a valuable communication tool and this will further enable management to experience the sentiments on the floor.

A major challenge to this program will be whether investigation will make use of in-house facilities or whether to outsource the function. The basic knowledge of artisan's permit them with the team to fulfil certain functions, but should be exercised whether doing in-house will provide the same level of comfort for specialised functions.

The decision to outsource versus the decision to perform the same function in-house requires a detailed study of the specific function as there will be benefits both sides. A detailed cost benefit analysis will have to be done and it is suggested that this will become the second phase of this program, where the new structure evaluates this in detail and make the appropriate suggestions - this will not be discussed as part of this investigation.

Sustainability of Structure

The centralised approach is normally the less expensive structure in a bigger company and or in a production company. This however dependent on a multitude of factors and variables, which we have tried to explain and ventilate in the document. It is clear from the analysis that this will be achieved during this restructuring process, but requires careful planning, monitoring and execution.

The collaborative approach of all the participants will be tested and change management will have to continuously provide energy into the system to retain motivation and not to lose sight of the objectives. The factors influencing the sustainability of this project will be divided into a steering team, a management implementation team and a communication and training team. Steering teams are used for the changeover phases of the project and to provide an independent monitoring function. Most of these changes will occur immediately and will take effect immediately, whilst the last 5%, also known as the closing phase, could take the same time as the first 95%.

This is where unexpected changes and identification of anomalies require amendments to align same with the original vision and mission and in line with the objectives set. The steering teams, in conjunction with the plant manager will fulfil these functions and provide regular feedback on the achievements, but simultaneously identify possible deficiencies in the system.

The success of the restructuring, based on the centralisation of core functions will also be considered as a dry run for using the same philosophy in other functions in the company. The spread of specific skills, linked with wider general knowledge will be considered for implementation in other divisions if it yields the desired effect. The comfort provided to the plant manager of spreading the skills base will provide additional cover when key positions will become vacant.

The risk of losing critical knowledge or skills is mitigated in the maintenance and production section as explained in the training plan in **Figure 24: Internal Training Program**. The plan illustrates the bottom up communication and documentation approach to artisans receiving the required information timeously. Communication will be supported by schedules or reports documenting information for capturing on the CMMS. This communication strategy is measurable and can be monitored for efficacy accordingly to the Procsi's Theory.

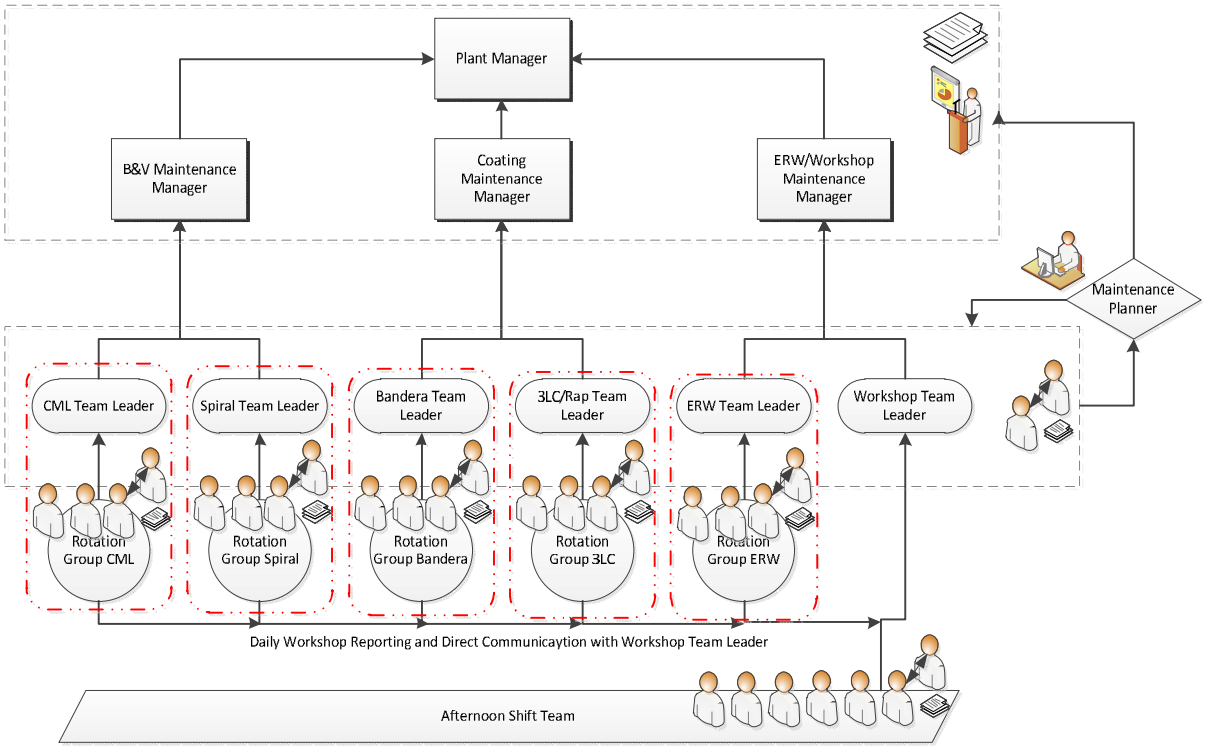


Figure 25: Internal Communication Plan (Appendix E)

The basis of the meetings and discussions originates from monitoring the schedules done by the rotational groups. The rotational group start with plant specific communication and interactions with the respective Team Leaders to gain a deeper understanding of the condition and availability of all the machines in the plant. The specific communication will be supported by specific schedules to provide substance to the review process. Trend analysis will be done from the schedules submitted, which will assist in the appropriate and correct actions to be taken as explained in **Figure 14: CMMS** System[25].

Verbal feedback will be provided by the Team Leader for the specific shift to the workshop Team Leader regarding the maintenance report from the specific shift. Afternoon artisans will submit the required reports done for the workshop Team Leader to assess the following morning, which will be collaborated by the verbal feedback by the Team Leader from the morning shift the following morning. Verified schedules will be submitted to the planner for capturing and discussion on scheduled maintenance or breakdown meetings, which will be done directly or via the preventative maintenance route as illustrated in **Figure 14: CMMS** System[26].

The planner will create reports for all levels and requirements. Team Leaders will receive the plant availability details and breakdown reports, along with their artisan evaluations on a daily basis. In addition to this, the workshop Team Leader will receive evaluations on the plant availability and breakdowns from the artisans and the workshop Team Leader. These evaluations will include spares used, cost of repairs and how widespread the downtime was. The Managers will receive weekly and monthly availability and breakdown reports, including the associated cost. The Line manager for the workshop will receive a skill and cost

[25] Chapter 4, Strategic Process
[26] Chapter 4, Strategic Process

utilisation analysis to evaluate the artisan utilisation of resources and efficacy within the group.

Sustainability of Assets

The manufacturing industry is dependent on knowledgeable and skilled people who can operate the complex machines, maintain these machines and sustain the production it requires to provide the company with a steady income stream at a profitable margin and return to the shareholders. Managing the skills base requires human resource processes and procedures – managing the physical assets requires additional systems which will guide the individuals to operate and maintain these complex machines.

The CMMS will provide this platform for managing the physical assets. The knowledge gained from the CMMS will amongst other benefits, be used to determine when preventative maintenance is required or when a major overhaul of a machine is needed. These two processes of human intervention and assets management will run concurrent and be managed by the Executive management. Policing the interaction between all the participants requires processes and procedures to be implemented and monitored to ensure the highest level of achievement.

The monitoring function will indicate deviations and permit time for rectifications and re-evaluations. The CMMS will also assist with this function. Team Leaders need to manage the CMMS system to allow constant feedback and interaction with participating employees as per **Figure 25: Internal Communication Plan**. The future focus should be RCM and this can be accomplished with a proper strategy and communication plan.

CMMS Role in Sustainability

The CMMS is a system that captures information and produce reports which can be used in analysing certain functions it covers. The quality of the information output is dependent on the quality of the inputs (garbage in, garbage out). The system do not analyse the information, but produce the outcome of cumulative reports (inputs) in a more structure way, thereby assisting in the production of these reports.

The flaw in the system is the system's dependency on the ability of individuals to capture the correct and detailed information – the system only provides reports (output) on what was reported and captured (inputs). The quality of the input reports must be monitored by one level up until we have reached a point where sufficient trust exists in the system, before we can move away from the one up approach.

The Team Leaders and Section Managers will review schedules on a quarterly basis to keep up-to-date with changes or machine specifications. This ensures a RCM approach by managing the CMMS to work according to the requirements of the assets. The CMMS system is therefore a tool for managers to understand the requirements of the assets by managing the people who are co-responsible for the maintenance and operation of it.

Conclusion

The new strategy was developed to improve communications, reduce downtime, improve the cost ratio for the company and directly impact the lives of the maintenance function. This strategy and change require effort and tenacity over an extended period of time, whilst maintaining the energy and momentum the process will create.

Managing the assets, human and physical will always be challenging, but requires tenacity and endurance to enjoy the fruits from the tree. Maintaining a system with integrity (CMMS) will require discipline, hence the control measures built into this new strategy. The controls can be relaxed over a period of time or once the new processes and procedures become business as usual.

Chapter 7: Conclusion

This chapter will provide an overview on the information collected and provide a roadmap on how the information was utilised to amend the current vision and mission into objectives and an implementation plan to facilitate these changes. The chapter will further highlight the problem areas and challenges which might exist in the existing scenario to where we want to be in the future.

This was organised via an implementation plan with clear objectives and strategies to be adhered to. The culmination of vision, mission, objectives and strategies, implementation plan and monitoring function will provide the basis for the change management, supported by the interaction of management (all levels) and human resources. The ultimate goal is to improve the plant efficacy, reduce cost and improve the company and shareholders' return, but simultaneously improve the customers experience and create a sustainable future for the company and its employees.

Hypothesis

It was obvious that the maintenance function did not operate at full capacity or optimally. This was identified as an area which requires change to improve the customer experience as well as the cost benefit to the company. The external AMIP and internal (Questionnaire) assessment were not very complementary regarding the maintenance function and confirmed by this hypothesis that poor machine availability was identified as one of the main reasons for the lack of optimal output in the manufacturing plant.

This was exacerbated by the substandard maintenance processes and procedures, including the lack of timeous proper preventative maintenance. The company should improve the customer experience as late or delayed deliveries culminated into contracts not being reviewed or renewed.

Theory

The core literature gives a brief overview of strategic and change management theories which form the basis for this improvement project. Strategic management was identified as an imperative for this process and discussed in chapter 3. Change was required to improve the maintenance experience by the clients or customers and a roadmap was suggested by using a strategic plan to ensure that all objectives are met without compromising the moral and/ or motivational levels.

Chapter 4 used strategic management and planning processes to develop a measurable tool to achieve the desired outcome and used change management in Chapter 5 as the implementation mechanism. The basic principles of Poters Forces and Baldgride were used to ensure a constant link between all internal and external clients and suppliers.

Evaluation

Chapter 3 analyses employee reaction and perceptions of the "as is" position of the company Responses to a set of predetermined questions were evaluated to gain a deeper understanding of the level of satisfaction that the employees are experiencing whilst in the employment of the company. The feedback was relatively neutral to positive, with certain areas being perceived as possible challenging areas. The process indicates a disconnect between the higher expectations from the management team and the perception of the maintenance unit, who was content with their current output.

This negative view regarding the perception of the maintenance unit was echoed by the Executive team and the production team. Strong views were expressed regarding the maintenance unit's ability to adhere to policies, procedures and processes or the lack of proper process and procedures. The Executive and management teams express a concern for the lack of discipline and control in the decentralised structure and the need to adopt a customer centric approach.

Strategy

The company was ready for changes and chapter 4 deals with the formulation of the proposed strategy, supported by a set of objectives to achieve the desired improvements as expressed by the various management teams. This strategy is focused on implementing measures and structures to provide a platform for sustainable change and facilitate the process of change to the new improved desired state. These proposed changes will be supported by other departments and function to permit the changes, without interrupting the normal day-to-day production output required.

The objectives and strategy envisaged changes and proposed the following –

- Group centralisation for all artisans;
- Dedicated and demarcated work and rest areas;
- Training provided on specific skills functions in the plant, but not excluding interpersonal skills, human resources and management;
- The introduction of a new structure and revised job description with moderate changes in the reporting lines;
- The introduction of a customer centric approach;
- Reduction in downtime;
- Preventative maintenance programs and procedures;
- Monitoring process to improve the general quality output of the maintenance unit; and
- Creating a more collaborative culture with emphasis on inter and intra dependencies.

The weaknesses and the challenges were identified and a process was implemented to counter same or to control the risks associated with it. The more controlled environment will initially put strict processes and procedures in place to ensure no production losses, but this will be relaxed as the confidence levels of the individuals involved improve. The rotational plans and proposals will increase the general level of knowledge, experience and exposure and further mitigates the company's risk of key individuals leaving the company abruptly.

The matrix system of reporting will provide a further input into the performance assessment of the team and the individuals involved. The dependency on detailed reporting and recording of events will be closely monitored for correctness and timeous reporting to improve the quality of inputs.

Implementation plan

Implementing a new strategy requires detailed planning and projections, supported by a clear implementation plan. This implementation plan is the process whereby employees will experience change in their day-to-day lives, which could lead to uncertainty and possibly a

loss of confidence if the changes are being considered as insurmountable or too difficult from their old true and trusted ways.

The plan will include providing support on the floor, but also the emotional aspect of dealing with a change environment. Communication structures will provide a continuous flow of information. The implementation plan and the application thereof will be evaluated on an on-going basis by the Executive team and other substructures reporting to the executives. Any deviations from the roadmap to change will be discussed and re-evaluated to consider and approve new actions to counter or prevent certain actions or behaviour.

Sustainability

The word “sustainability” is derived from the Latin word *sustinere* which has more than ten explanations according to the modern dictionary. The just of these explanations can be found in the three words we want to use to successfully implement the proposed changes:

- Maintain;
- Support; and
- Endurance.

The sustainability of the proposed changes will influence all involved on an economic or social level. The availability of the plant will improve production, the promotions will affect employees and the changes in the processes and procedures will provide an extra level of comfort to the company, it will further addresses the personal risk and physical risks individuals will face during their tenure with the company.

There is no doubt that this is a viable and sustainable alternative to the existing operations and procedures.

Bibliography

Mind Tools Ltd. (2007). *Porter's Five Forces*. Retrieved May 20, 2011, from Mind Tools.

Abdullab, F. (2009). *McDonlads case study: Strategic Management* . Jordan: University of Jordan.

Branch, K. (2002). *Participative Management and Employee and Stackholder involvement.* San Francisco: Berrett-Koehler Publishers.

Cateora, P. R. (2008). International marketing. In M. C. Philip R. Cateora, *International marketing - Fourteenth edition.* Irwin: McGraw-Hill.

Connemara, Murray & Roberts. (2011). Manager of Others. *Manage Other - Leadership Development.* Gauteng: Connemara.

Cooper, D. R. (2006). Business Research Methords. In P. S. Donald R. Cooper, *Business Research Methords, Edition 9.* Asia: McGraw-Hill.

Covey, S. *The 7 Habbits of highly sucsessful people.*

Dess, G. L. (2005). *Strategic Management 2nd edition.* New York: McGraw-Hill Irwin.

Dobson, P. (2004). Strategic Management . In S. K. Dobson P.W, *Strategic Management: Issues and Cases.* Blackwell Publishers.

Doherty, P. (June 2006). *Change Management: A CA IT Servise Management Process Map.* CA Inc.

Dr.Malan, A. (2010). Lecture 6: Project and Change Management. *Engineering Management.* Gauteng: University of Johannesburg.

Hall Longmore. (2011). *About Us*. Retrieved April 28, 2011, from Hall Longmore PTY ltd.: http://www.hall-longmore.co.za/about_us.html

Hiatt, B. (2009, February 6). *Articals on total productive maintenance management*. Retrieved February 2, 2011, from TPM on line: www.tpmonline.com/articals_on_total_productive_maintenance/management

Howe, D. (2010). *Dictionary*. Retrieved April 28, 2011, from http://dictionary.reference.com/browse/change+management

Internet Center for Management and Business Adninistration, I. (2010). *The strategic Planning Process*. Retrieved March 3, 2010, from QuickMBA: http://www.quickmba.com/strategy/strategic-planning/

Jones, J. A. (2004, Aapril 15). *Strategic and Business*. Retrieved April 26, 2011, from Strategic Business: http://www.strategic-business.com/artical

Lombard, J. (2002). *Maintenance Management strategy for the Kempton Park Tembisa electricity department.* Johannesburg: Universtiy of Johannesburg.

Lussier, R. (2006). *Management Fundamentals, 3rd edition – concepts, applications, skill development. .* Thomson South-Westren .

Mackechnie, D. I. (2007). Strategic Management. *Stamford Online.* America : Stamford.

Malan, A. (2010, June). Engineering Management – Lecture 6: Project and Change Management Electronic Slides. Johannesburg, Gauteng, South Africa: University of Johannesburg.

Mol, D. A. Goal Setting. *Arnold Mol.* South Africa: Dr. Arnold Mol.

Mol, D. A. Motivation. *Arnold Mol.* South Africa: Dr. Arnold Mol.

NZCER. (2010, November 27). *The Knowledge Age*. Retrieved March 6, 2011, from Shifting Thinking: http://www.shiftingthinking.org/?page_id=58

Palmer, D. (2008, November). *Centralized vs. decentralized maintenance*. Retrieved May 19, 2011, from Reliable Plant: http://www.reliableplant.com/articals/print/14665

Paul Steel. (n.d.). *Total Intergrated Baldridge Excellence System*. Retrieved April 21, 2013, from Baldridge21: www.baldridge21.com/Baldridge%20Best%20Practices.htm

Porter, M. (2010). *Porter's Five Forces*. Retrieved March 3, 2011, from Quick MBA: http://www.quickmba.com/strategy/porter.shtml

Pragma, PTY Ltd. (2009). *Hall Longmore Wadeville Maintenance Business Processes.* Johannesburg: Pragma.

Random House, I. (2011). *Dictionary*. Retrieved April 28, 2011, from http:..dictionary.reference.com/browse/strategy

The woodhouse partnership Ltd. (n.d.). *Pas 55*. Retrieved Jan 18, 2010, from Pas 55 management system: www.pas55.net

Wells, D. (1996). *Strategic Mangemnet for Senior Leaders.* Virginia: Department of the navy total quality leadership office.

Woodhouse, J. (2009). *PAS-55:Asset Management: Concepts and Practices. Version 003.* PAS-55.

Appendix A

(Questionnaire)

	Questions	Negative	Very Low	Low	Medium	High	Very High	Positive	Reason
1	Rate the **quality of maintenance** work		1	2	3	4	5		
2	Rate the positive **culture of the maintenance** group		1	2	3	4	5		
3	Rate the amount of substandard work from competent **maintenance people**		1	2	3	4	5		
4	Rate the possibility of employees involved with **theft and sabotage**		1	2	3	4	5		
5	Rate the **overuse of specific suppliers**		1	2	3	4	5		
6	Rate the relationship between **maintenance and stores**		1	2	3	4	5		
7	Rate the amount of **waste regarding recycling**		1	2	3	4	5		
8	Rate the **level of motivation** among the maintenance group		1	2	3	4	5		
9	Rate the **level of discipline** used in maintenance department		1	2	3	4	5		
10	Rate the maintenance **interest in safety** and safe working procedures		1	2	3	4	5		
11	Rate the maintenance **interest in schedules and job cards**		1	2	3	4	5		
12	Rate the **knowledge of processes and procedures** maintenance employees have		1	2	3	4	5		
13	Rate the relationship between **maintenance and production**		1	2	3	4	5		
14	Rate the effort from management to **improve maintenance employee skills**		1	2	3	4	5		
15	Rate the possibility of employees involved with **corruption**		1	2	3	4	5		
16	Rate the usage of **Service level Agreement** between business units		1	2	3	4	5		
17	Rate the positive impact if the **maintenance is centralized,** 2 central workshops		1	2	3	4	5		
18	Rate the **transparency of the company**		1	2	3	4	5		
19	Rate the relationship between **maintenance and other sections of maintenance**		1	2	3	4	5		
20	Rate the negative **impact of 2010 Retrenchments**		1	2	3	4	5		
21	Rate the impact of the **uncertain production future** on employees		1	2	3	4	5		
22	Rate the amount of maintenance **quick fixes** made around the plant		1	2	3	4	5		
23	Rate the interest in **breakdown reporting** in maintenance		1	2	3	4	5		
24	Rate the value of **restructuring** of the maintenance employees with more levels of authority		1	2	3	4	5		

Appendix B

(Interviewers Sheet)

	Number on interview			
	Time and Location			
	Employee name and surname			
1	Participants Department			Objective view
2	Participants Plant section			Objective view (Section)
3	Participants involvement with Maintenance			Level of information

		Nothing	No interest	Done	Interested	Enthusiastic	
4	Knowledge about maintenance at Hall Longmore	0%	25%	50%	75%	100%	Objective view
5	The participants thought through on the topic	0%	25%	50%	75%	100%	Quality
6	The clarity of the communication	0%	25%	50%	75%	100%	Quality
7	The level of ease in communication with participant	0%	25%	50%	75%	100%	Quality
8	The level of motivation to share	0%	25%	50%	75%	100%	Quality

If one of the above % is 0% or 25% you can stop the interview due to quality reasons

Quality of Interview						
100%	100%	100%	100%	100%		100%
75%	100%	100%	100%	100%		75%
75%	75%	100%	100%	100%		56%
75%	75%	75%	100%	100%		42%
75%	75%	75%	75%	100%		32%
75%	75%	75%	75%	75%		24%

Appendix C

(Results Table)

Number of interviews	39	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	Total	1.75 < ¤ < 2.25	2.25< ¤ < 2.75	2.75 < ¤ < 3. 25	3.25 < ¤ < 3.75	3.75< ¤< 4.25	Maint. Management	Maint. Artisans	Maint. Group	Production Manage	Deviation	Maint. Man vs Prod	Maint. Artisans vs M	Maint. Vs Productio
Maint. Management		Mpumi Mtambo	Devan Vosloo	Gert Strydom	Johan Marx	Deon Pretorius	Koos Taljaart	Don Grey	Hans Venter	Fanie Mkuwana	Bheki Ngosha	Yusimusi Khuswayo	Themba Masuku	Cyril Maseko	Elias Lerata	Marlon Franke	Koos Baaitjies	Jeffery Ngema	Dewald de Kock	William Mmela	Edward Rasasheane	Oupa Morobi	Jabhile Morea	Sarel Kombrink	Kennith Mkhwanzi	Carl Smith	Lucian Mitrea	Theodore Tailer	Zama	George Pebane	Piet Terblanch	Joe	Reggie Gounden	Brown	Rasmati	Frank Maritz	Robert Wright	Donald	Wimpy	Corneli																
Prod. Management																																																										
Maint. Artisan																																																										
Name And surname																																																										
oblems @ Low numbe		4	4	0	1	10	4	1	2	5	7	4	11	6	8	5	4	7	3	6	15	12	13	2	3	5	2	0	13	6	1	6	0	0	6	0	6	1	3	6																
1	1 2 3 4 5	3	3	3	3	4	3	4	3	4	3	3	4	3	2	3	4	3	3	4	5	3	3	4	3	3	3	4	4	3	3	4	4	3	4	3	3	3	3	3	1	3.33				¤		3.25	3.40	3.36	3.27	0.15	0.02	0.15	-0.08
2	1 2 3 4 5	4	2	3	2	3	3	3	3	3	2	4	5	3	3	2	5	3	3	4	4	2	5	4	4	3	3	4	5	4	4	5	4	2	4	3	2	4	3	2	5	3.36				¤		2.88	3.55	3.36	3.36	0.68	0.49	0.68	0.01
3	1 2 3 4 5	3	3	3	4	4	3	3	4	4	3	3	5	3	1	2	3	4	3	4	1	3	2	3	4	3	4	4	4	4	3	5	4	3	4	4	1	3	3	4	5	3.28			¤			3.38	3.15	3.21	3.45	0.30	0.08	-0.23	0.24
4	1 2 3 4 5	2	2	3	3	1	3	4	5	4	5	4	5	5	3	3	4	4	2	3	5	2	5	3	4	3	5	3	5	5	4	1	3	2	5	4	5	2	4	2	13	3.51				¤		2.88	3.85	3.57	3.36	0.98	0.49	0.98	-0.21
5	1 2 3 4 5	3	2	3	4	3	3	1	3	3	2	3	1	3	4	2	3	2	3	4	1	1	3	3	4	2	3	3	3	3	3	4	2	3	3	2	4	3	3	1	5	2.72		¤				2.75	2.65	2.68	2.82	0.17	0.07	-0.10	0.14
6	1 2 3 4 5	3	3	4	2	5	1	4	4	3	4	2	5	4	4	2	4	2	2	4	1	1	2	4	3	2	4	3	1	3	4	2	4	3	3	2	3	4	3	3	6	3.00			¤			3.25	2.85	2.96	3.09	0.40	-0.16	-0.40	0.13
7	1 2 3 4 5	2	3	3	2	2	5	2	4	4	2	4	2	4	5	3	3	2	3	2	3	4	1	3	2	4	4	3	3	4	3	4	2	2	4	3	3	4	2	2	3	3.00			¤			2.88	3.05	3.00	3.00	0.18	0.13	0.18	0.00
8	1 2 3 4 5	3	2	3	3	2	2	3	3	3	2	5	5	3	4	3	4	2	2	4	1	1	5	4	4	2	4	3	5	4	4	4	3	3	4	3	1	3	2	1	8	3.05			¤			2.63	3.30	3.11	2.91	0.68	0.28	0.68	-0.20
9	1 2 3 4 5	4	3	3	3	4	2	2	3	3	4	5	4	3	4	2	4	4	2	4	1	3	5	4	4	4	2	4	3	3	3	3	3	2	3	2	5	4	2	1	5	3.18			¤			3.00	3.45	3.32	2.82	0.63	-0.18	0.45	-0.50
10	1 2 3 4 5	4	3	4	4	5	1	4	4	5	4	3	5	3	5	3	5	4	4	4	5	1	5	5	5	5	4	4	5	4	3	4	4	3	5	3	4	4	3	3	14	3.92					¤	3.63	4.20	4.04	3.64	0.58	0.01	0.58	-0.40
11	1 2 3 4 5	1	3	3	4	5	1	2	4	4	2	3	5	5	5	1	4	3	4	4	5	1	1	2	3	3	3	3	4	4	4	5	4	2	4	2	4	4	3	2	11	3.23			¤			2.88	3.25	3.14	3.45	0.58	0.58	0.38	0.31
12	1 2 3 4 5	3	3	4	4	5	3	3	3	3	3	4	3	3	3	3	4	2	3	4	3	1	3	3	4	4	4	3	5	5	3	3	4	3	5	4	4	4	3	3	5	3.44				¤		3.50	3.25	3.32	3.73	0.48	0.23	-0.25	0.41
13	1 2 3 4 5	3	3	3	2	4	3	3	4	5	4	2	4	3	2	1	5	1	2	3	1	1	3	4	5	3	2	3	5	5	4	5	3	2	4	3	4	3	3	1	11	3.10			¤			3.13	2.95	3.00	3.36	0.41	0.24	-0.18	0.36
14	1 2 3 4 5	2	2	3	5	4	3	4	2	2	1	5	2	2	2	2	5	1	2	1	1	1	1	3	3	3	1	3	3	4	3	2	4	3	5	3	5	4	2	3	12	2.74		¤				3.13	2.20	2.46	3.45	1.25	0.33	-0.93	0.99
15	1 2 3 4 5	3	3	4	4	4	3	4	3	4	4	4	5	5	4	3	4	4	3	5	5	2	5	5	5	3	4	4	5	3	3	2	3	3	5	3	1	3	5	2	11	3.69					¤	3.50	4.15	3.96	3.00	1.15	-0.50	0.65	-0.96
16	1 2 3 4 5	2	1	3	3	4	3	2	3	4	3	3	3	2	5	5	3	2	1	1	3	2	4	3	3	1	3	2	3	1	1	4	3	2	3	2	4	4	3	2	8	2.72		¤				2.63	2.80	2.75	2.64	0.18	0.01	0.18	-0.11
17	1 2 3 4 5	4	5	3	2	1	3	4	4	5	5	3	4	5	1	2	4	5	4	4	3	5	3	3	3	5	3	3	4	4	3	3	4	4	3	4	3	3	4	3	9	3.54				¤		3.25	3.70	3.57	3.45	0.45	0.20	0.45	-0.12
18	1 2 3 4 5	4	4	4	2	4	3	2	3	4	1	4	3	3	1	2	3	4	3	2	3	2	4	4	3	3	2	3	3	1	3	2	4	3	3	4	3	3	4	3	3	2.97			¤			3.25	2.85	2.96	3.00	0.40	-0.25	-0.40	0.04
19	1 2 3 4 5	4	2	3	3	4	3	4	4	4	1	4	3	2	2	4	3	1	1	3	3	1	1	4	4	3	3	3	5	1	2	3	3	2	2	3	4	3	4	2	7	2.85			¤			3.38	2.75	2.93	2.64	0.74	-0.74	-0.63	-0.29
#	1 2 3 4 5	5	4	2	2	5	3	3	1	1	1	1	1	1	3	1	2	1	1	1	1	2	3	4	3	1	3	2	1	2	3	1	2	2	1	2	2	1	1	2	19	2.00	¤					3.13	1.70	2.11	1.73	1.43	-1.40	-1.43	-0.38
21	1 2 3 4 5	1	3	2	3	5	3	3	2	3	1	3	1	1	4	1	3	1	2	1	3	5	1	2	3	1	3	2	1	2	3	4	2	3	3	2	3	3	1	3	13	2.38		¤				2.75	2.10	2.29	2.64	0.65	-0.11	-0.65	0.35
#	1 2 3 4 5	3	3	3	2	5	3	3	3	3	4	3	3	4	3	3	3	4	2	3	1	3	1	4	3	4	3	3	1	3	4	3	2	2	3	3	2	3	2	4	4	2.92			¤			3.13	2.90	2.96	2.82	0.31	-0.31	-0.23	-0.15
#	1 2 3 4 5	2	1	3	4	5	3	3	3	5	4	4	3	2	5	2	4	4	3	5	5	1	4	2	4	3	4	4	4	3	4	4	4	2	3	3	3	3	4	1	8	3.33				¤		3.00	3.60	3.43	3.09	0.60	0.09	0.60	-0.34
#	1 2 3 4 5	5	5	3	4	3	3	4	4	4	4	3	3	3	3	4	4	5	4	2	3	3	1	3	3	3	3	4	5	4	3	2	3	4	4	4	4	3	3	1	6	3.41				¤		3.88	3.35	3.50	3.18	0.69	-0.69	-0.53	-0.32
Knowledge		0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	0.75	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	0.75	0.75	1.00	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	95%																
Thought through		1.00	1.00	1.00	0.75	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	0.75	0.75	1.00	1.00	1.00	0.75	1.00	0.75	1.00	0.75	94%																
Communication Clarity		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	97%																
Communication Ease		1.00	1.00	0.75	1.00	0.75	0.75	1.00	1.00	1.00	0.75	0.75	1.00	1.00	1.00	1.00	0.75	0.75	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	94%																
Motivation to share		1.00	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	0.75	0.75	1.00	95%	75						75	75	75	74				
		75%	100%	56%	56%	56%	56%	100%	75%	100%	75%	75%	56%	100%	56%	100%	56%	75%	75%	100%	56%	75%	75%	75%	75%	100%	56%	56%	100%	100%	75%	42%	100%	100%	100%	75%	100%	42%	75%	75%	77%	Damaging	Problems	Neutral	Good	Excellent	72%	77%	76%	80%				

Appendix D

(Results Table Grouped)

39	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	27	16	17	18	19	33	20	21	22	23	24	25	26	28	29	30	31	32	34	35	36	37	38	39									
Name And surname	Mpumi Mtambo	Devan Vosloo	Gert Strydom	Johan Marx	Deon Pretorius	Koos Baaijies	Koos Taljaart	Oupa Morobi	Joe	Reggie Gounden	Dewald de Kock	Fanie Mkuwana	George Pebane	Vusimusi Khuswayo	Themba Masuku	Rasmati	Cyril Maseko	Sarel Kombrink	Marlon Franke	Lucian Mitrea	Piet Terblanch	Jeffery Ngema	Theodore Tailer	Brown	Carl Smith	Edward Rasasheane	Donald	Jabhile Morea	Kennith Mkhwanzi	Don Grey	Robert Wright	Zama	Wimpy	Bheki Ngosha	Frank Maritz	William Mmela	Elias Lerata	Hans Venter	Corneli		Total	All area's	3LC and Rap Plant	ERW Auxilinies	Exopy Coating	Spiral Mill and Auxilar	Bandera Line	ERW Mill	Deviation
	4	4	0	1	10	4	4	12	5	0	3	6	6	5	10	6	6	2	5	3	1	7	0	0	5	14	1	13	3	1	6	13	3	7	0	7	7	2	6									
1	3	3	3	3	4	4	3	3	4	4	3	4	3	3	4	4	3	4	3	3	3	3	4	3	3	5	3	3	3	4	3	4	3	3	3	4	2	3	3	1	3.33	3.20	3.60	3.43	3.25	3.43	3.40	3.00	0.60
2	4	2	3	2	3	5	3	2	5	4	3	3	4	4	5	4	3	4	2	3	4	3	4	2	3	4	4	5	4	3	2	5	3	2	3	4	3	3	2	5	3.36	2.80	3.80	3.71	3.25	3.57	3.40	2.83	1.00
3	3	3	3	4	4	3	3	4	4	3	3	5	3	1	2	3	4	3	4	1	3	2	3	4	3	4	4	4	4	3	5	4	3	4	4	1	3	3	4	5	3.28	3.40	3.40	3.00	2.75	3.43	3.80	3.17	1.05
4	2	2	3	3	1	4	3	2	1	3	2	4	5	4	5	5	5	3	3	5	4	4	3	2	3	5	2	5	4	4	5	5	4	5	4	3	3	5	2	13	3.51	2.20	2.60	4.29	3.75	3.43	4.40	3.67	2.20
5	3	2	3	4	3	3	3	1	4	2	3	3	3	3	1	3	3	3	2	3	3	2	3	3	2	1	3	3	4	1	4	3	3	2	2	4	4	3	1	5	2.72	3.00	2.60	2.71	2.75	2.43	3.00	2.67	0.57
6	3	3	4	2	5	4	1	1	2	4	2	3	3	2	5	3	4	4	2	4	4	2	3	3	2	1	4	2	3	4	3	1	3	4	2	4	4	4	3	6	3.00	3.40	2.40	3.14	3.50	2.43	2.80	3.50	1.10
7	2	3	3	2	2	3	5	4	4	2	3	4	4	4	2	4	4	3	3	4	3	2	3	2	4	3	4	1	2	2	3	3	2	2	3	2	5	4	2	3	3.00	2.40	3.60	3.57	3.25	2.71	2.40	3.00	1.20
8	3	2	3	3	2	4	2	1	4	3	2	3	4	5	5	4	3	4	3	4	4	2	3	3	2	1	3	5	4	3	1	5	2	2	3	4	4	3	1	8	3.05	2.60	2.80	3.71	3.75	2.71	3.00	2.83	1.15
9	4	3	3	3	4	4	2	3	3	3	2	3	3	5	4	3	3	4	2	2	3	4	4	2	4	1	4	5	4	2	5	3	2	4	2	4	4	3	1	5	3.18	3.40	3.00	3.29	2.75	3.43	3.20	3.00	0.68
10	4	3	4	4	5	5	1	1	4	4	4	5	4	3	5	5	3	5	3	4	3	4	4	3	5	5	4	5	5	4	4	5	3	4	3	4	5	4	3	14	3.92	4.00	3.00	4.14	3.75	4.29	4.20	3.83	1.29
11	1	3	3	4	5	4	1	1	5	4	4	4	4	4	3	5	4	5	2	1	3	4	3	3	2	3	5	4	1	3	2	4	4	3	2	2	4	5	4	2	11	3.23	3.20	3.00	4.14	2.50	3.00	3.20	3.17	1.64
12	3	3	4	4	5	4	3	1	3	4	3	3	5	4	3	5	3	3	3	4	3	2	3	3	4	3	4	3	4	3	4	5	3	3	4	4	3	3	3	5	3.44	3.80	3.00	3.71	3.25	3.14	3.80	3.33	0.80
13	3	3	3	2	4	5	3	1	5	3	2	5	5	2	4	4	3	4	1	2	4	1	3	2	3	1	3	3	5	3	4	5	3	4	3	3	2	4	1	11	3.10	3.00	3.40	3.57	2.75	2.29	4.00	2.83	1.71
14	2	2	3	5	4	5	3	1	2	4	2	2	4	5	2	5	2	3	2	1	3	1	3	3	3	1	4	1	3	4	5	3	2	1	3	1	2	2	3	12	2.74	3.20	3.00	3.14	2.25	2.29	3.40	2.00	1.40
15	3	3	4	4	4	4	3	2	2	3	3	4	3	4	5	5	5	5	3	4	3	4	4	3	3	5	3	5	5	4	1	5	5	4	3	5	4	3	2	11	3.69	3.60	2.80	4.14	3.75	3.86	4.00	3.50	1.34
16	2	1	3	3	4	3	3	2	4	3	1	4	1	3	3	3	2	3	5	3	1	2	2	2	1	3	4	4	3	2	4	3	3	3	2	1	5	3	2	8	2.72	2.60	3.00	2.43	3.00	2.57	3.00	2.67	0.57
17	4	5	3	2	1	4	3	5	3	4	4	5	4	3	4	3	5	3	2	3	3	5	3	4	5	3	3	3	3	4	3	4	4	5	4	4	1	4	3	9	3.54	3.00	3.80	4.00	2.75	3.71	3.60	3.50	1.25
18	4	4	4	2	4	3	3	2	2	4	3	4	1	4	3	4	3	4	2	2	3	4	3	3	3	3	3	4	3	2	3	3	4	1	3	2	1	3	3	3	2.97	3.60	2.80	3.14	2.75	3.29	3.00	2.17	1.43
19	4	2	3	3	4	3	3	1	3	3	1	4	1	4	3	2	2	4	4	3	2	1	3	2	3	3	3	1	4	4	4	5	4	1	3	3	2	4	2	7	2.85	3.20	2.60	2.43	3.25	2.29	4.20	2.50	1.91
20	5	4	2	2	5	2	3	2	1	2	1	1	2	1	1	1	1	4	1	3	3	1	2	2	1	1	1	3	3	3	2	1	1	1	2	1	3	1	2	13	2.00	3.60	2.00	1.14	2.75	1.57	2.00	1.67	2.46
21	1	3	2	3	5	3	3	5	4	2	2	3	2	3	1	3	1	2	1	3	3	1	2	3	1	3	3	1	3	3	3	1	1	1	2	1	4	2	3	13	2.38	2.80	3.40	2.14	2.25	2.00	2.20	2.17	1.40
22	3	3	3	2	5	3	3	3	3	2	2	3	3	3	3	3	4	4	3	3	4	4	3	2	4	1	3	1	3	3	2	1	2	4	3	3	3	3	4	4	2.92	3.20	2.80	3.00	3.50	2.57	2.20	3.33	1.30
23	2	1	3	4	5	4	3	1	4	4	3	5	3	4	3	3	2	2	2	4	4	4	4	2	3	5	3	4	4	3	3	4	4	4	3	5	5	3	1	8	3.33	3.00	3.20	3.29	3.00	3.57	3.60	3.50	0.60
24	5	5	3	4	3	4	3	3	2	3	4	4	4	3	3	4	3	3	4	3	3	5	4	4	3	3	3	1	3	4	4	5	3	4	4	2	3	4	1	6	3.41	4.00	3.00	3.57	3.25	3.29	3.80	3.00	1.00

Appendix E

(Small Print Figures)